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ADDENDUM ENVIRONMENTAL IMPACT STATEMENT

WESTERN ENERGY COMPANY'S ROSEBUD MINE

AREA B, SECOND EXTENSION

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ENVIRONMENTAL IMPACT STATEMENT

WESTERN ENERGY COMPANY'S
ROSEBUD MINE

AREA B, SECOND EXTENSION

Montana Department of State Lands
August 1983

Dennis Hemmer, Commissioner

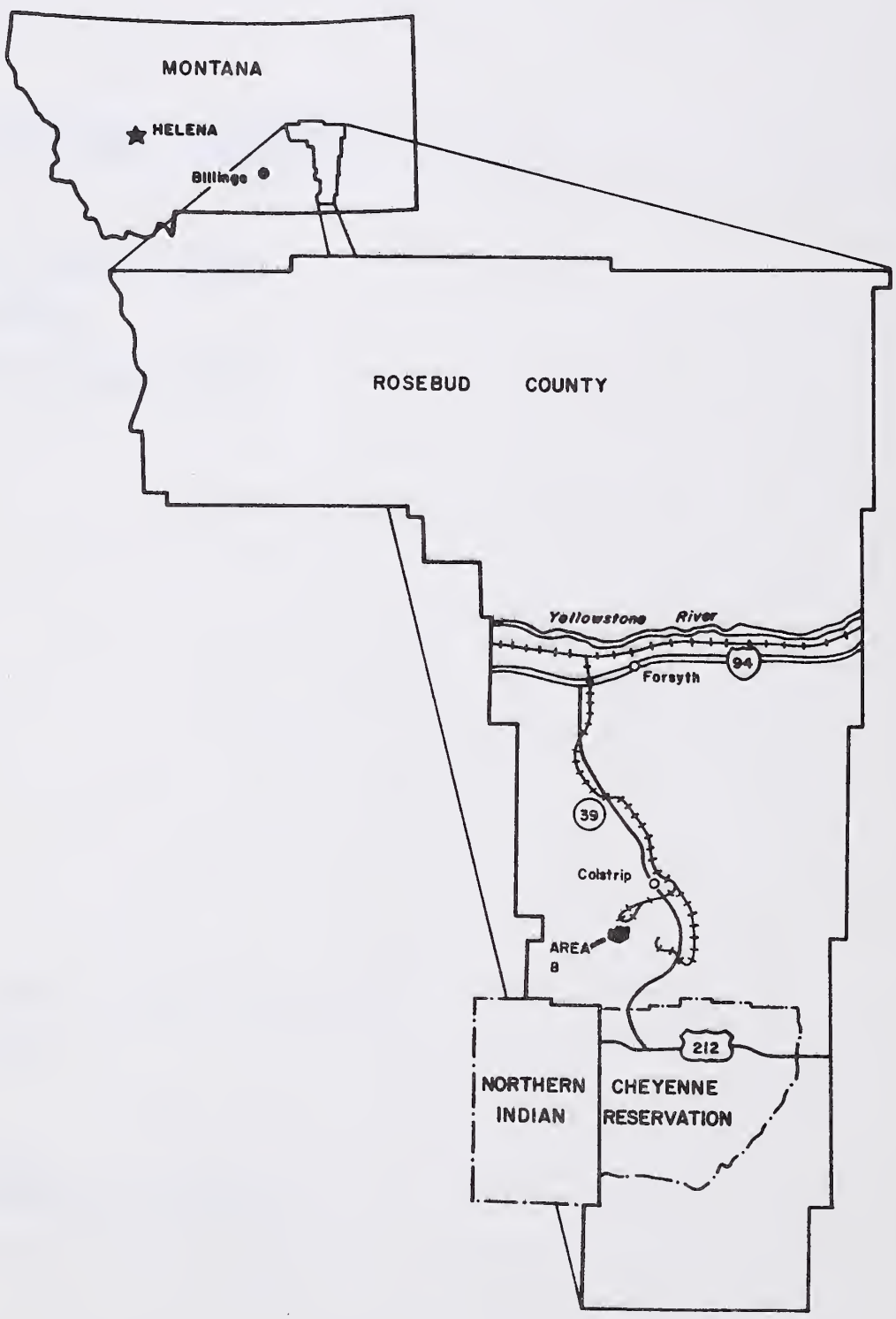


FIGURE S-1--Location of the Area B Extension

ROSEBUD MINE
AREA B
SECOND EXTENSION

In March, 1983, the Department of State Lands issued a draft environmental impact statement (EIS) on Western Energy Company's proposal to extend Area B of the Rosebud Mine. The draft document was revised and this final EIS is the result.

Action Under Consideration

Western Energy Company proposes to extend Area B of the Rosebud Mine into sections 7, 8, 17, and 18 of T1N, R41E and sections 12 and 13 of T1N, R40E. (See fig. S-1.) The Commissioner of State Lands must decide whether to approve an amendment to Western Energy's Area B permit as applied for by the company, to deny the amendment, or to approve the amendment subject to stipulations.

The Company's Proposal

Western Energy proposes to mine 42.2 million tons of coal over eight years at an average rate of 5.3 million tons per year from both private and Federal coal leases. The entire extension area would cover 1,820 acres, of which 1,627 acres would be disturbed during mining. If the permit amendment is approved, Western Energy would begin operations immediately.

Summary of Impacts

Geology. The impacts on the geologic setting of Area B would not be significant. The revegetated landscape would be as stable as the premining landscape. A few gullies might develop in the uplands along the southern boundary of Area B on land used for highwall reduction. Small draws could develop along drainages due to headward channel development. Development of gullies and draws would not adversely affect postmining land uses.

Overburden characteristics are not expected to adversely affect postmining revegetation success.

Hydrology. Mining would double to triple total dissolved solids (TDS) in the extension area's ground water. This TDS increase, together with increases from other permitted mining, could in turn double TDS concentrations in East

Fork of Armells Creek alluvial ground water. This increase, bringing alluvial TDS concentrations to 5,000 mg/l, could last for thousands of years. Assuming premining ground water flows resume after mining, the Area B extension would account for 10 to 50 percent of the total increase. Seepage from industrial waste-water ponds would further increase TDS concentrations in the East Fork of Armells Creek alluvium downstream of Colstrip for 50 to several hundred years.

Added together, all Colstrip-area development could, during low-flow periods, limit the use of the East Fork of Armells Creek for stock watering. Area B ground water, in contrast, would be usable for stock watering, the primary postmining water use. Cumulative development could also reduce plant productivity and change species composition on lowlands next to the East Fork of Armells Creek. How far changes could extend downstream is not known.

Soils. Once respread during reclamation, the soils in the proposed disturbance area would present few limitations to the growth of new vegetation. Some impacts to soils would be unavoidable during soil salvage, replacement, and some stockpiling. The impacts could result in increased sensitivity of the disturbance area to mismanagement and drought for an unknown period of time after mining.

Vegetation. 1,627 acres of vegetation would be destroyed by mining over a period of 8 years. Reclamation would reestablish plant communities primarily of native species. Rangeland forage production would probably increase; however, plant diversity would be lower for probably several years after mining.

Wildlife. Impacts to wildlife species would be minimal and localized. Species associated with upland grassland habitat type would be most affected. Some nesting and brooding cover for sharp-tailed grouse might be lost, along with some antelope summer range.

Climate. Continued mining in Area B would not affect the climate. Particulate emissions would remain at or near ground level, and total emissions would be too small to affect either precipitation or radiation balance.

Air Quality. Mining in sections 7, 8, 17, 18 of Area B would not significantly affect present air quality.

Employment and Income. The extension of Area B would allow the continuation of--not increase--the number of jobs at the Rosebud Mine.

Social Conditions. The population of Rosebud County, Colstrip, and Forsyth are projected to peak in 1983, decline through 1986, and remain relatively stable from 1986 through 1993. The percentage of the population attributable to Area B extension is and would remain small. The extension would probably contribute to the stability of Colstrip's social life, especially from 1983 to 1986, a period of rapid population decline.

Social and Community Services. The population arising from Area B extension would continue to contribute to the strain on the services in Colstrip that are now inadequate. The inadequate services include housing and medical services. Even so, inadequacies in service would last only through 1985, after which Colstrip's population is projected to fall sharply, eliminating service deficiencies.

Fiscal Conditions. Over the life of the Area B extension, school districts and State, Federal, and county governments would receive about $155.9 million in tax revenues.

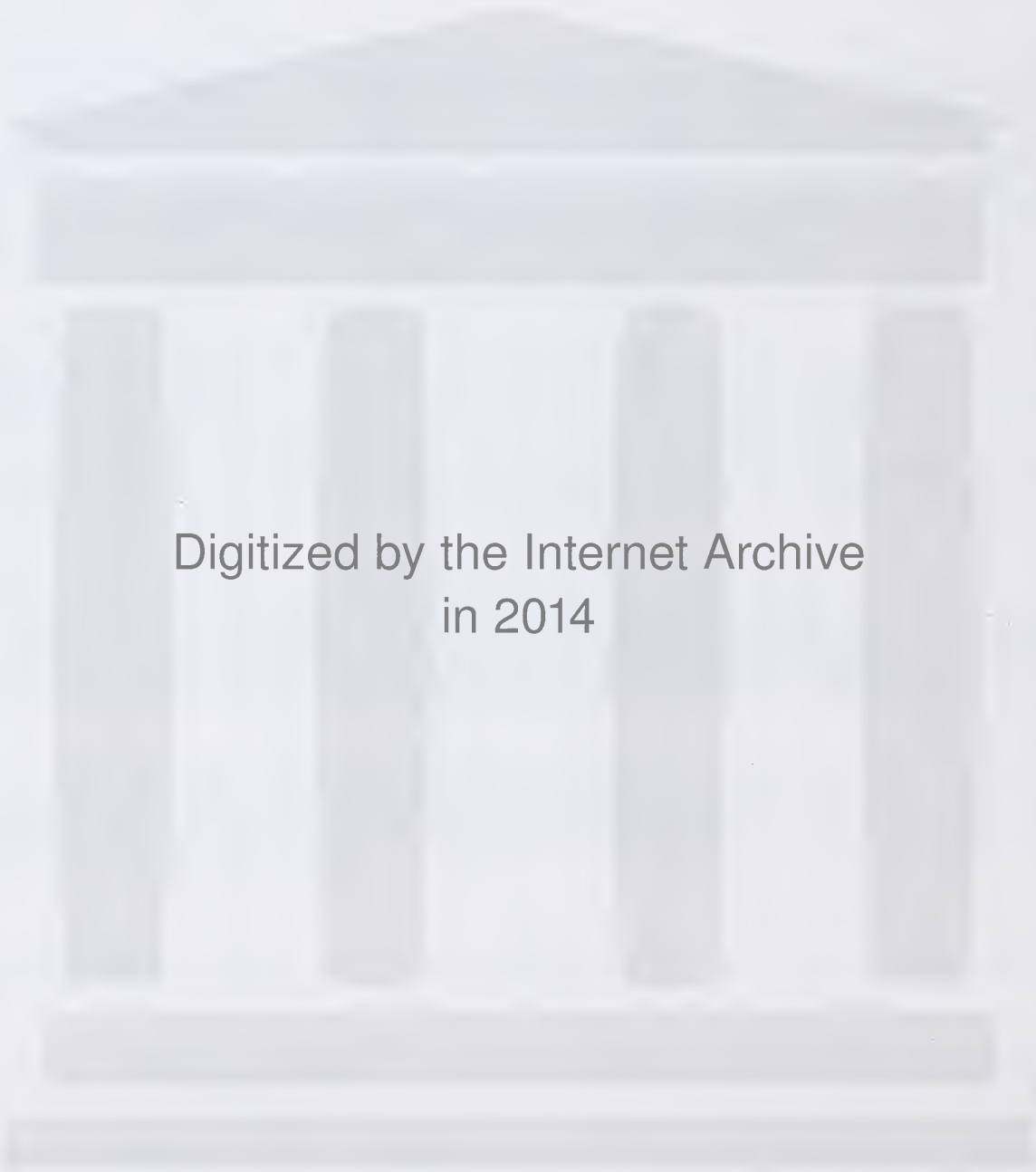
Land Use. The Area B extension would temporarily displace grazing on 1,820 acres.

Transportation. The extension of Area B would not noticeably change either train or highway traffic levels in Rosebud County.

Recreation. Since the extension of Area B would not increase population, no impact on recreation facilities or sites in or near Colstrip is expected.

Cultural Resources. Mining would mainly affect resources found in the one-mile "buffer zone," or band, around the permit area: several homesteads may be damaged by blasting or vandalism; prehistoric sites may be vandalized or collected.

Aesthetics. Aesthetic impacts following reclamation would be insignificant. Within several decades after the completion of mining, neither the vegetation nor the topography of the postmining landscape would contrast with surrounding unmined land.



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THE EIS: WHY IT IS WRITTEN
WHO IS INVOLVED
WHAT DECISIONS MUST BE MADE

Western Energy Company proposes to extend Area B of its Rosebud Mine into parts of sections 7, 8, 17, and 18 of T1N, R4E and parts of sections 12 and 13 of T1N, R41E. Area B lies within Rosebud County, just south of Colstrip, Montana. The company holds a permit for its existing Area B operation. But the Department of State Lands must approve an amendment to the permit, in accordance with the Montana Strip and Underground Mine Reclamation Act, before mining can extend into the new area.

THE EIS

The Department of State Lands has determined that the proposed mining and reclamation plan amendment may "significantly affect the quality of the human environment." The Department has therefore prepared an environmental impact statement (EIS) (Montana Environmental Policy Act [MEPA], 1971).

To date, as required by MEPA, the Department has--

(1) issued a draft EIS (in March 1983).

(2) encouraged and accepted public comments on the draft (until April 13, 1983).

With the publication of this final EIS, the Department has completed the EIS process. This final document contains (a) corrections and clarifications of the draft text and (b) responses to each substantive comment. All changes and additions to the draft have been underlined. Readers familiar with the draft can speed their review by reading the underlined sections only.

No sooner than 15 days following publication of the final EIS, the Department must make a decision on Western Energy's application.

The EIS describes for the public (1) the company's proposal, (2) the lands, people, and resources that the proposal would affect, (3) the impacts--mostly unavoidable--of the proposal, and (4) mitigating measures that would reduce the proposal's impact. The EIS does not present the Department's proposed decision. The document merely helps ensure that the proposed operation is well planned and environmentally sound and that concerns of all are heard and considered.

PREVIOUS EISs ON AREA B

In 1976 the Department of State Lands prepared an EIS on the expansion of Western Energy's Rosebud Mine into section 3, T1N, R41E of Area B. In 1980 the Department supplemented the 1976 statement with an EIS that focused on the extension of Area B into sections 4, 9, and 10 of T1N, R41E. The Department is now supplementing the most recent EIS, with this addendum EIS, which focuses on the areas to be mined in a second extension of Area B.

Other documents pertinent to the Rosebud Mine have been written, such as the Rosebud Mine Comprehensive Environmental Impact Study, published in final in July, 1983, and the Montco Mine EIS. The comprehensive study contains information on the effects of mining the entire Rosebud Mine, including Area B. The Montco Mine EIS contains information pertinent to Rosebud County's land use, fiscal, transportation, and employment and income conditions. On many subjects, this addendum EIS is brief. For further information, the reader is directed to both the Comprehensive and Montco Mine documents.

SCOPE OF ANALYSIS

The EIS analyzes the immediate and cumulative effects of Western Energy's proposed Area B extension mining and reclamation plan. The document discusses the impacts the mine would have on the physical environment, including soils, vegetation, water quality, air quality, and a number of other subjects. The EIS also projects (1) demands on environmental resources of land, water, air, and energy and (2) the impact the mine would have on human populations, including land use, fiscal conditions, social conditions, and other subjects. The impacts discussed generally include direct impacts from mining, off-site impacts caused by mining, and other impacts resulting from changes in employment and economic activity.

The analysis is based on the mining and reclamation plan submitted by Western Energy and, where additional data were considered necessary, on the most up-to-date information available.

AGENCY RESPONSIBILITIES

A number of agencies have participated in the writing or review of the EIS and a number will participate in the issuance of permits necessary for a mining operation.

Montana Department of State Lands

The Department of State Lands (DSL) administers the Montana Strip and Underground Mine Reclamation Act (82-4-2 MCA), under which Western Energy has applied for an amended permit. The act provides for protection of environmental and cultural resources in and around the proposed mining area.

The strip mine act was passed in 1973. It requires that any company removing or intending to remove coal must first obtain a permit from the Department of State Lands. In its permit application a company must submit a plan that meets all the requirements of the act. The plan must present data of sufficient quality and quantity to allow the Department to make a complete review.

The mining plan must show that the company will salvage and replace all topsoil from the land to be mined, restore the mined land to the approximate premining contour, and plant a permanent and diverse cover of vegetation composed mainly of native species. The company must also minimize impacts on wildlife, protect alluvial valley floors, and preserve the hydrologic functions (such as subirrigation) of valleys. These provisions, as well as a variety of others, must be met by the company.

Typically, after receipt of an application, the Department issues a "deficiency" letter. The letter points out to the company the parts of the mine plan that do not meet the law. The company, in consultation with the Department, then changes the plan. Through frequent meetings and the use of the deficiency letter (and often a second) the company and the Department continually improve the mine plan. When the plan has adequately addressed all provisions of the law, it is deemed complete. It is on this completed plan that the Department bases its permit decision.

Montana Department of Health and Environmental Sciences

Western Energy Company was issued an air quality permit (No. 1483) by the Air Quality Bureau of the Department of Health and Environmental Sciences for "one surface coal mine and extraction facilities comprised of Areas A, B, and E" on October 22, 1980. The permit is valid until completion of mining.

Western Energy has filed with the Water Quality Bureau for renewal of its Montana Pollutant Discharge Elimination System (MPDES) permit (No. 0023965). The permit would cover surface water discharges from pits and ponds and sanitary wastewater discharges for Western Energy's entire Rosebud Mine. Discharges have to meet effluent limitations and standards established by the Montana Board of Health and Environmental Sciences.

State Historic Preservation Office

Pursuant to the Montana Strip and Underground Mine Reclamation Act (MCA 82-4-201 through 82-4-228), the Montana Antiquities Act (MCA 22-3-401 through 22-3-442), and the National Historical Preservation Act (P.L. 89-665 as amended and

reauthorized E.O. 11593), the State Historic Preservation Office has the obligation to cooperate with and advise the Department of State Lands when potentially valuable historical, archaeological, or other cultural resources are located in a project area. Part of the advice given to the Department may include comments on a company's plan for impact mitigation of sites in a project area that are eligible for nomination to the National Register of Historic Places. In addition, the office reviews the EIS to ensure compliance with cultural resource regulations.

In the process of project implementation, the State Historic Preservation Office is responsible for issuing antiquities permits for projects that lie on State-owned lands. After the survey is complete, the office seeks a determination from the Keeper of the National Register for sites believed to be eligible for listing on the National Register of Historic Places.

U.S. Fish and Wildlife Service

Under the Surface Mining Control and Reclamation Act, the U.S. Fish and Wildlife Service must review this statement for compliance with the Endangered Species Act.

Office of Surface Mining

The U.S. Department of the Interior, Office of Surface Mining (OSM), must also approve the mining and reclamation plan amendments to Western Energy's Area B under the Surface Mining Control and Reclamation Act of 1977, since some of the coal proposed for mining is Federal coal. Federal approval, however, is not considered in this addendum.

ADMINISTRATIVE ALTERNATIVES

After evaluation of this addendum EIS and the mine plan amendment, the Department of State Lands may take one of the following five administrative alternatives. Any of these alternatives could be chosen to reduce the impacts of the proposed amendment to Western Energy's Area B mining and reclamation plan or to comply with legal requirements and lease terms.

1. Approve the Permit Amendment as Proposed

The environmental effects of approving the amendment to Western Energy's Area B mining and reclamation plan as proposed are contained in Chapter III.

2. No Action

If no action were taken by the Department within 240 days after receipt of a completed application for a mining and reclamation permit, it is possible that the permit could be statutorily approved by default.

Montana does not have a formal administrative alternative to "defer action" following the receipt of a completed application for a mine and reclamation permit.

3. Deny the Permit Amendment

The Department may reject a proposed plan that does not meet Montana's permanent regulatory program (ARM 26.4.301 et seq.). The effects of denying the permit amendment would be that the physical environment of the mine plan area would remain as described in chapter II. The changes in the social and economic conditions of the county that would result from permit denial are described in Chapter IV.

4. Selectively Deny the Permit Amendment

The Department would deny the permit to mine in a specified area where reclamation consistent with the requirements of the act is not possible. The specified areas would include those having special, exceptional, critical, or unique characteristics, or where mining would affect the use, enjoyment, or fundamental character of neighboring land having the above special characteristics. The impact analysis in this EIS has not disclosed any such lands, but that does not preclude such action following review of this EIS.

5. Approve the Permit Amendment with Stipulations

If parts of the proposed plan were considered unacceptable, the Department could grant the permit amendment with stipulations. Possible stipulations would include any modifications or additions to the proposed plans that the Commissioner of State lands considered necessary to meet the requirements of State laws.

Modifications or additions that would reduce the impacts of the mine are listed as separate sections at the end of each subject in chapter III. These sections are titled "Mitigating Measures." Not until the granting of the permit by the Commissioner of State Lands would it be known which stipulations would be attached to the permit to comply with the Montana Strip and Underground Mine Reclamation Act.

WESTERN ENERGY COMPANY'S PROPOSAL

Area B, two miles south of Colstrip, Montana, is one of five mining units making up the Rosebud Mine. (See fig. I-1.) Western Energy Company has applied to the Department of State Lands to amend its mining and reclamation permit for Area B. The company has mined out section 3, T1N, R41E of Area B, under a permit granted following a 1976 EIS. The company is now mining sections 4, 9, and 10 under a permit granted following a 1980 EIS on the expansion of Area B. Western Energy is applying for an amendment to its 1980 permit to further extend Area B into sections 7, 8, 17, and 18 of T1N, R41E and sections 12 and 13, T1N, R40E. (See fig. I-2.)

There are a total of 1,794 acres now in Area B. Western Energy proposes to extend the area another 1,820 acres; 1,574 acres would be bonded for mining level disturbance, which would include areas used for mining, roads, highwall reduction, soil and overburden stockpiles, and facilities. The remaining 246 acres would be bonded for associated disturbance.

Mining in sections 4, 9, and 10 began in 1980. Mining in the sections discussed in this addendum (7, 8, 17, 18 of T1N, R41E, and 12 and 13 of T1N, 40E) would begin as soon as the mining permit is approved. Coal production would last 8 years.

COAL RESERVES

Six coal seams lie within Area B. Two of these, the Rosebud and the McKay, are mineable by today's surface mining technology. Western Energy, however, would mine only the Rosebud seam, the upper of the two. The McKay seam, lying an average of 23 feet below the Rosebud, is of poorer quality, containing higher amounts of sulfur, iron, and sodium than the Rosebud seam. (See table I-1.) The iron makes the McKay coal tend to slag at normal boiler operating temperatures; the sodium increases the likelihood of boiler tube deterioration. Western Energy has not found a market for the McKay coal and does not plan to mine the seam, although the nearby Peabody mine does mine and market a blend of the McKay and Rosebud coal.

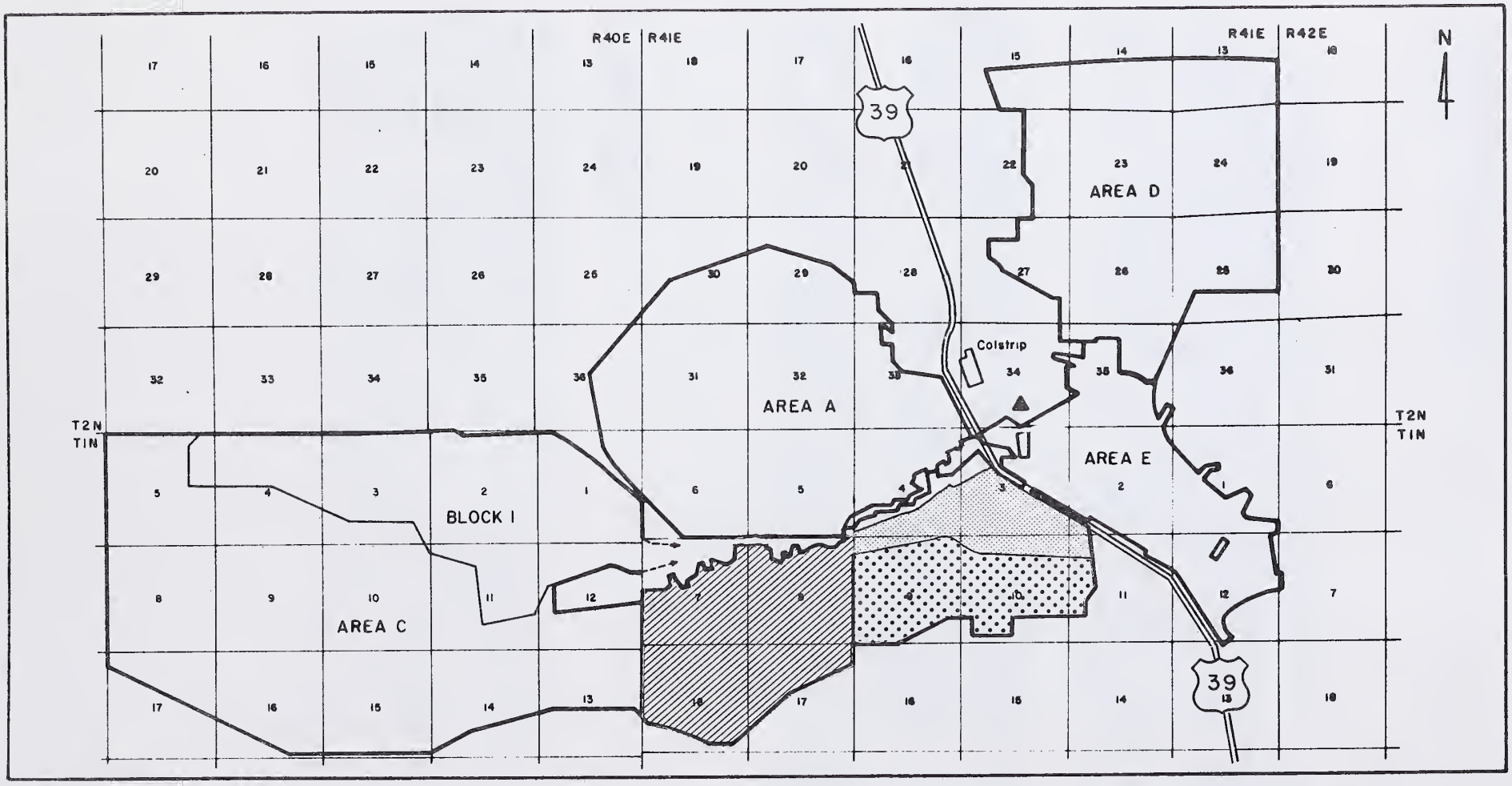


FIGURE I-1--The Five Areas of the Rosebud Mine

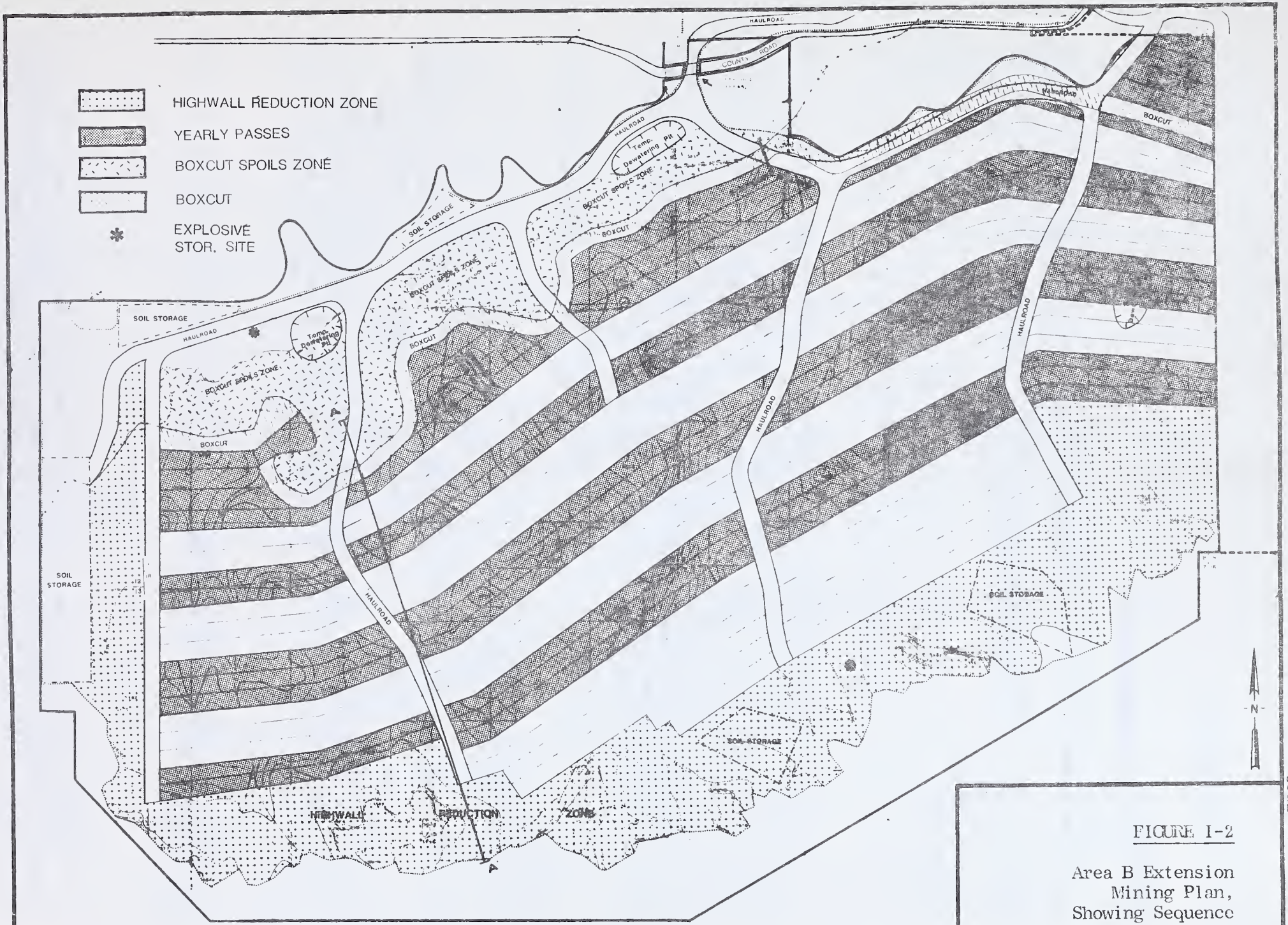


FIGURE I-2

Area B Extension
Mining Plan,
Showing Sequence
of Mining by Year

TABLE I-1
Coal Quality as Received

Measure	Coal Seam	
	Rosebud	McKay
BTU Per Pound	8,438	8,533
Percent Moisture	25.16	26.64
Percent Ash	9.78	7.40
Percent Sulfur	1.08	1.51

The Rosebud seam within the application area (in sections 7, 8, 17, & 18) contains 42.2 million tons of economically recoverable coal. (See table I-2.) These reserves would be mined over 8 years at an annual average rate of 5.3 million tons per year. Four to five percent of the total reserves would be lost because of regulatory constraints, spillage, and limits on present coal extraction technology. Projected coal production from Area B is shown in table I-3. Sections 12 and 13, although part of the permit area, would not be mined and are therefore not included in estimates of coal reserves. These sections would only be used for highwall reduction during reclamation.

TABLE I-2
Coal Reserves in Area B
(Sections 7, 8, 17, 18)

Seam	Average Thickness (Feet)	Total Reserves (millions of tons)	Losses	Net Mineable Reserves (millions of tons)
Rosebud	22.3	44	4-5%	42.2
McKay	8.0	14.4	--*	--*

*The McKay seam would not be mined

Western Energy proposes to ship all coal from Area B to meet long-term contracts with the same customers in the upper Midwest that have received coal in the past. (See table I-4.) Electric utilities would burn most of the coal

TABLE I-3
Annual Production from Area B

Years	Tons (millions)		
	(4, 9, 10)	(7, 8, 17, & 18)	Total
1	7.3	0	7.3
2	7.0	0	7.0
3	3.3	0	3.3
4	1.5	6.2	7.7
5	1.7	4.1	5.8
6	2.6	4.4	7.0
7	1.9	6.2	8.1
8	2.2	5.7	7.9
9	3.0	5.4	8.4
10	0.9	4.5	5.4
11	0	5.7	5.7
Total	31.4	42.2	73.6

in coal-fired electric generating plants. About 200,000 tons per year would be burned for space and process heat.

An average of 120 feet of overburden covers the Rosebud seam. The overburden is shallowest--less than 50 feet in places--near the East Fork of Armells Creek, where Western Energy would begin mining. Overburden cover increases to 200 feet where the Rosebud seam underlies the high bluffs in sections 17 and 18.

Western Energy now owns or has coal leases for the entire area proposed for mining. (See fig. I-3.) Of the 1,820 acres of the surface that are part of the permit amendment application, Western Energy leases about 30 percent from Burlington Northern, Inc., and Consolidation Coal Company. The rest is owned by Western Energy. (See fig. I-4.)

MINING PLAN

Facilities

Western Energy proposes to haul coal from Area B about 2.5 miles to the coal handling facilities at Area A, north of the East Fork of Armells Creek. Coal from both Areas A and Area B would be loaded onto unit trains for shipping to

TABLE I-4
Previous Area B Coal Sales
(thousands of tons)

[Source: Western Energy Company, written commun., August 25, 1982]

Customer	1976	1977	1978	1979	1980	1981
Northern States Power[1] Sherburn 1 & 2[2] (Minn.)[3]	415	2,440	1,482	1,040	728	2,312
Wisconsin Power and Light[1] Columbia[2] (Wisc.)[3]	264	1,011	514	355	340	1,510
Upper Peninsula Generating[1] Marquette[2] (Mich.)[3]	0	35	56	59	45	258
Great Lakes Coal (St. Paul, Minn.)[3]	33	200	261	180	127	236
Lake Superior District Power[1] Bayfront[2] (Wisc.)[3]	2	14	25	6	0	9
Various Spot Market Sales[4]	0	0	0	0	0	1,162

[1]Electric utility
[2]Generating station receiving coal
[3]Coal destination
[4]Includes Montana Power Company, Minnesota Power and Light, Great Western Sugar Company, and several others

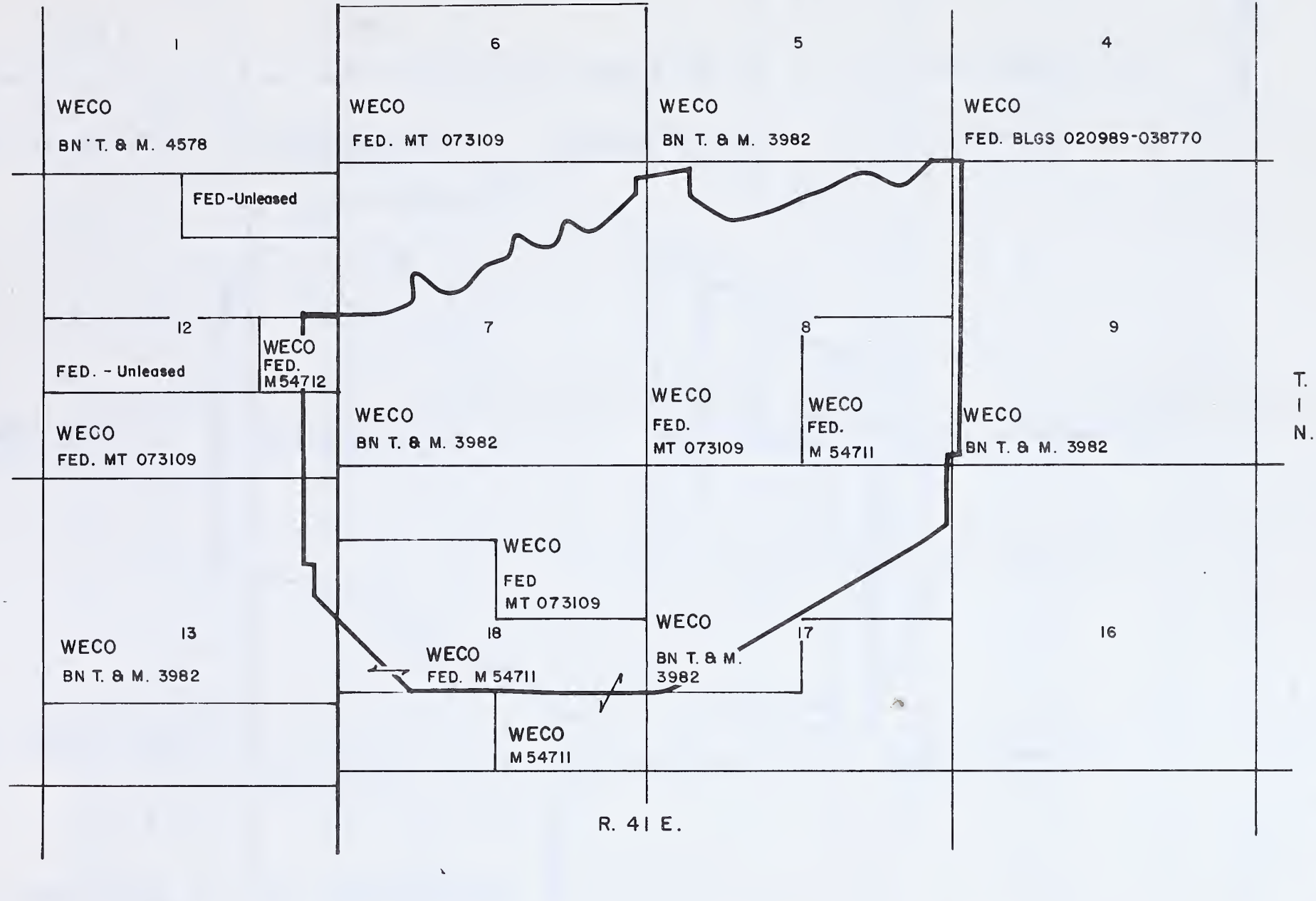


FIGURE I-3--Coal Ownership and Western Energy Leases in Area B

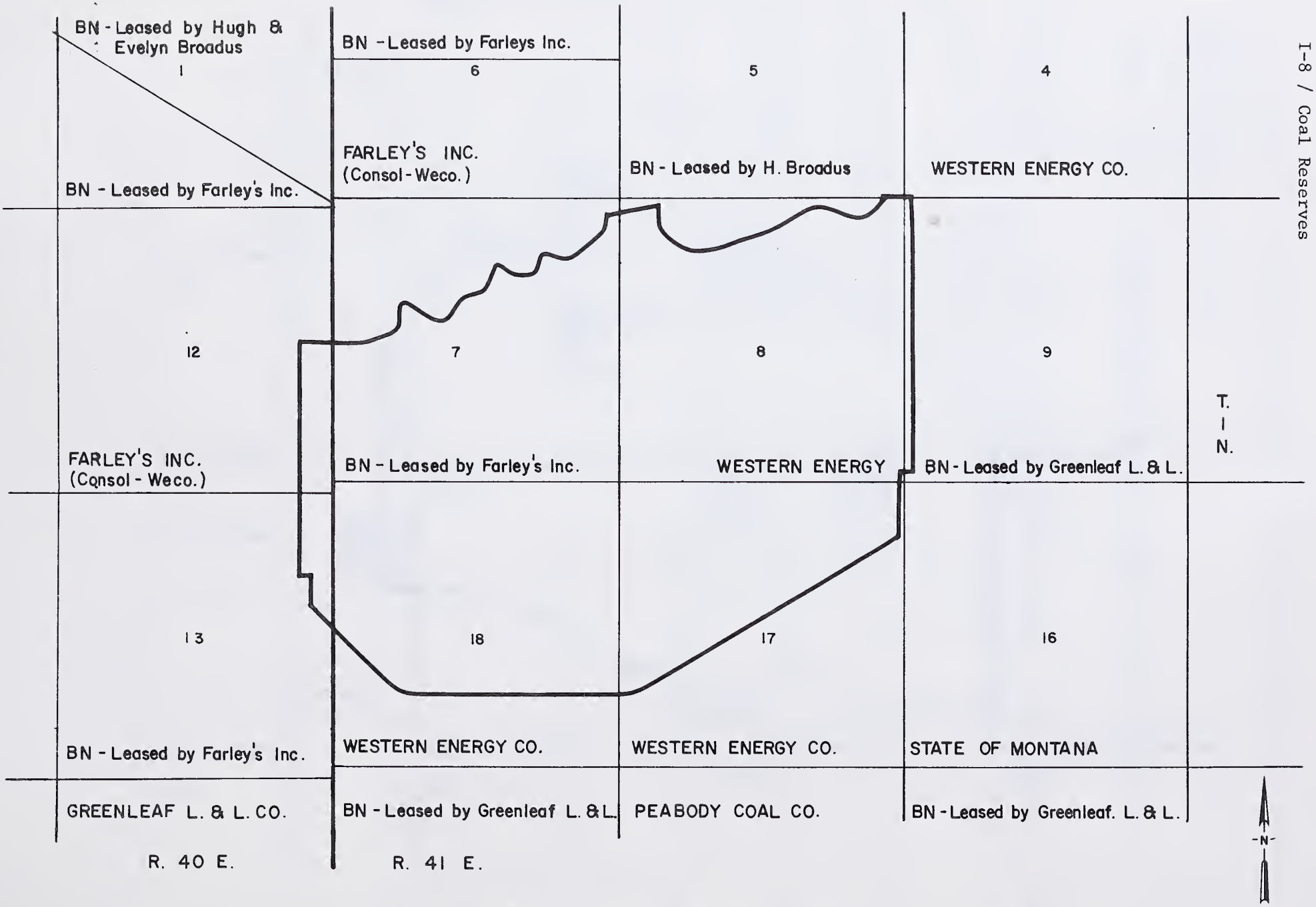


FIGURE I-4--Surface Ownership in Area B

customers. Western Energy does not plan to build new facilities for Area B. Facilities that are now used for both Areas A and B (fig. I-5) and that would continue in use include the following:

--A 2.0-mile access road to highway FAP 39.

--A 3.8-mile railroad spur and loop track in Area A.

--Several steel-framed structures, an office, a maintenance shop, change rooms and bath facilities, storage buildings, and a heavy-equipment wash facility.

--Fuel and explosive storage tanks.

--Coal-handling facilities at Area A, including primary and secondary crushers, coal storage pile, tipple loadout with weighing and sampling stations, and a unit train loadout.

--Water supply from Colstrip, a three-cell lagoon for domestic waste, and impoundments to collect water for dust suppression.

--Existing haul roads with new extensions into the pit.

--A 115 kV and a 12.5 kV powerline from Colstrip.

--Portable substations to provide power to equipment in the pit.

Mining Method

Western Energy proposes to strip mine Area B using dragline excavation. The company would begin mining by excavating a long boxcut (the first cut of the mine) just south of and parallel to the East Fork of Armells Creek in the northern half of sections 7 and 8. (See fig. I-2.) Mining would advance in a southerly direction as the dragline moves back and forth (east and west) across the mine area. The cuts in sections 7, 8, 17, and 18 would tie into the cuts in section 9 of the current permit area. Figure I-2 shows the areas to be mined by year throughout the life of the mine. Table I-5 shows the acres to be disturbed each year.

Before any excavation of overburden, scrapers would strip topsoil to an average depth of 8 to 9 inches. The scrapers would then strip subsoil to an average depth (below topsoil) of two feet. Following soil removal, the overburden would be drilled and blasted, and a dragline (sometimes assisted by scrapers) would strip the loosened overburden down to the Rosebud seam. The company would then drill and blast the Rosebud coal, and 17-cubic-yard shovels would load the coal into 120-ton coal haulers (trucks). The coal haulers would transport the coal to the Area A and B coal handling facilities, where the coal would be crushed and loaded into rail cars for shipment.

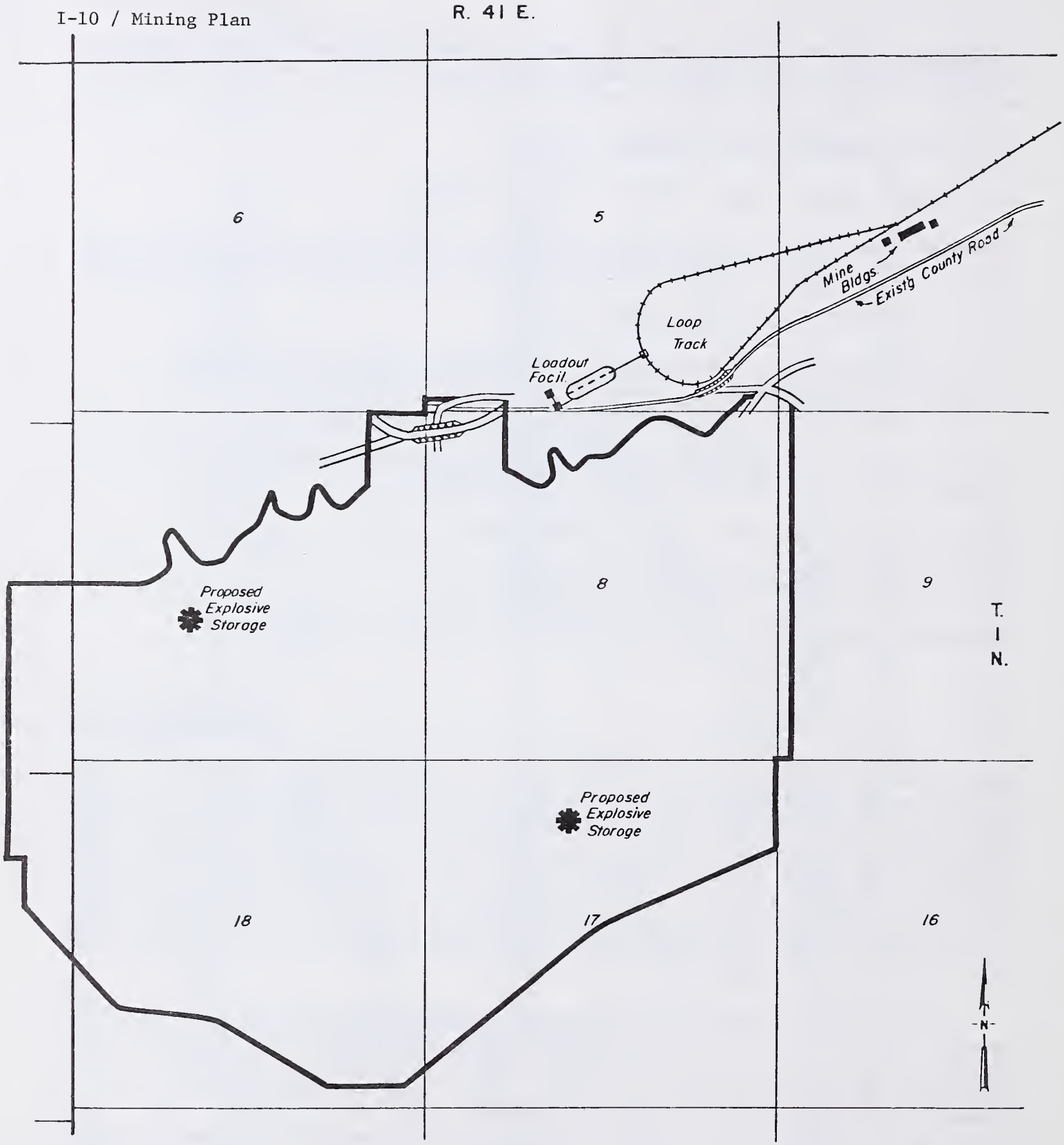


FIGURE I-5--Area B, Showing Facilities Shared with Area A

TABLE I-5
Acreage Disturbed Over Life of Mine--Area B

Year	Acres Disturbed (Sections 4, 9, 10)	Acres Disturbed (7, 8, 17, 18, 12, 13)
1	370	0
2	156	0
3	92	0
4	39	452
5	44	110
6	69	103
7	102	146
8	94	147
9	201	145
10	88	191
11	0	334
	1,255	1,628

During boxcut excavation, topsoil, subsoil, and overburden would be dumped in segregated storage piles outside the area to be mined. During excavation of the second and later cuts, the dragline would cast overburden directly into the mined-out pit left from the preceding cut. Scrapers taking topsoil and subsoil would respread the soil on mined-out pit areas that have been filled with overburden and regraded, avoiding topsoil stockpiling except during boxcut excavation.

Department of State Lands regulations require that during mining all disturbed surface drainage be passed through sediment ponds before leaving the permit area. Accordingly, Western Energy would detain all runoff from disturbed land, spoils, and soil stockpiles in sedimentation ponds capable of completely containing runoff from the 10-year 24-hour precipitation event. Berms, ditches, and sediment traps would intercept the runoff from haul roads and soil stockpiles. Western Energy has obtained Montana Pollution Discharge Elimination System (MPDES) permits from the Department of Health and Environmental Sciences for the proposed sedimentation ponds in Area B. The company is required to sample all discharge and provide the results of these samples to the Department of Health and Environmental Sciences and the Department of State Lands. Western Energy Company's MPDES permit stipulates that discharge water from the mine will not exceed the effluent standards listed in the permit.

During mining, ground water would drain into the mining cuts from Rosebud overburden, Rosebud coal, and possibly from East Fork of Armells Creek alluvium. Ground water inflow into the pit would be periodically pumped into sedimentation ponds. Some of this water would be used for dust suppression. When necessary, Western Energy would discharge excess water in accordance with its pollutant discharge (MPDES) permit.

Throughout the life of the mine Western Energy would monitor water levels and water quality in wells near the mine area. Monitoring would include continuous water level records for the Rosebud and McKay strata and East Fork Armells Creek alluvium both upgradient and downgradient of Area B. The company would submit water level and quality data quarterly to the Department of State Lands.

Employment Levels

At an average annual coal production rate of 5.3 million tons per year, the Area B extension would employ about 153 full-time workers.

RECLAMATION PLAN

Once the dragline has cast spoil from the active mining pit into the mined-out pit, crawler tractors (bulldozers) and scrapers would grade the spoils to approximately the premining contour. (See fig. I-6.) Scrapers and dozers would grade only along the contour, to minimize erosion and provide a surface that would prevent topsoil slippage. Slopes would not exceed 5:1 (20 percent). Any spoil material determined by field testing to be potentially harmful to growth of plant life after mining would be buried under 8 feet of nontoxic overburden.

During the final stages of spoil regrading, Western Energy would reconstruct the approximate premining drainages. All slopes between drainages would be constructed with a complex (convex-concave) profile, a configuration that minimizes erosion. Drainages would be constructed with a continuous concave profile, thereby avoiding nick points (short gullies through bulges in the profile). Drainage design would emphasize approximately the same channel and flood dimensions as those that existed before mining. Channels would be restored to their natural meandering pattern with geomorphically acceptable gradients.

When Western Energy reaches the edge of the area to be mined, the pit would create a "highwall," that is, a steep cut rising from the base of the Rosebud seam to the undisturbed surface. The company would fill the pit with stored spoils and then use crawler tractors and scrapers to break down, or "reduce," the remaining highwall and regrade it into complex slopes no steeper than 5:1. During the process, the mined area would be graded into the undisturbed land to make a smooth and stable transition in topography.

Following spoils grading, scrapers would continue the reclamation process by spreading subsoil to a depth of 1.5 to 2.5 feet and topsoil to a depth of 8 to 9 inches. Where possible, for all but the final passes, soil would be transported directly from a pass being prepared for mining to a pass being reclaimed. Stockpiled soil from the boxcut would be used only to reclaim the final pass and the land regraded during highwall reduction. Soil stockpiles would be seeded to prevent loss through erosion during the years of soil storage.

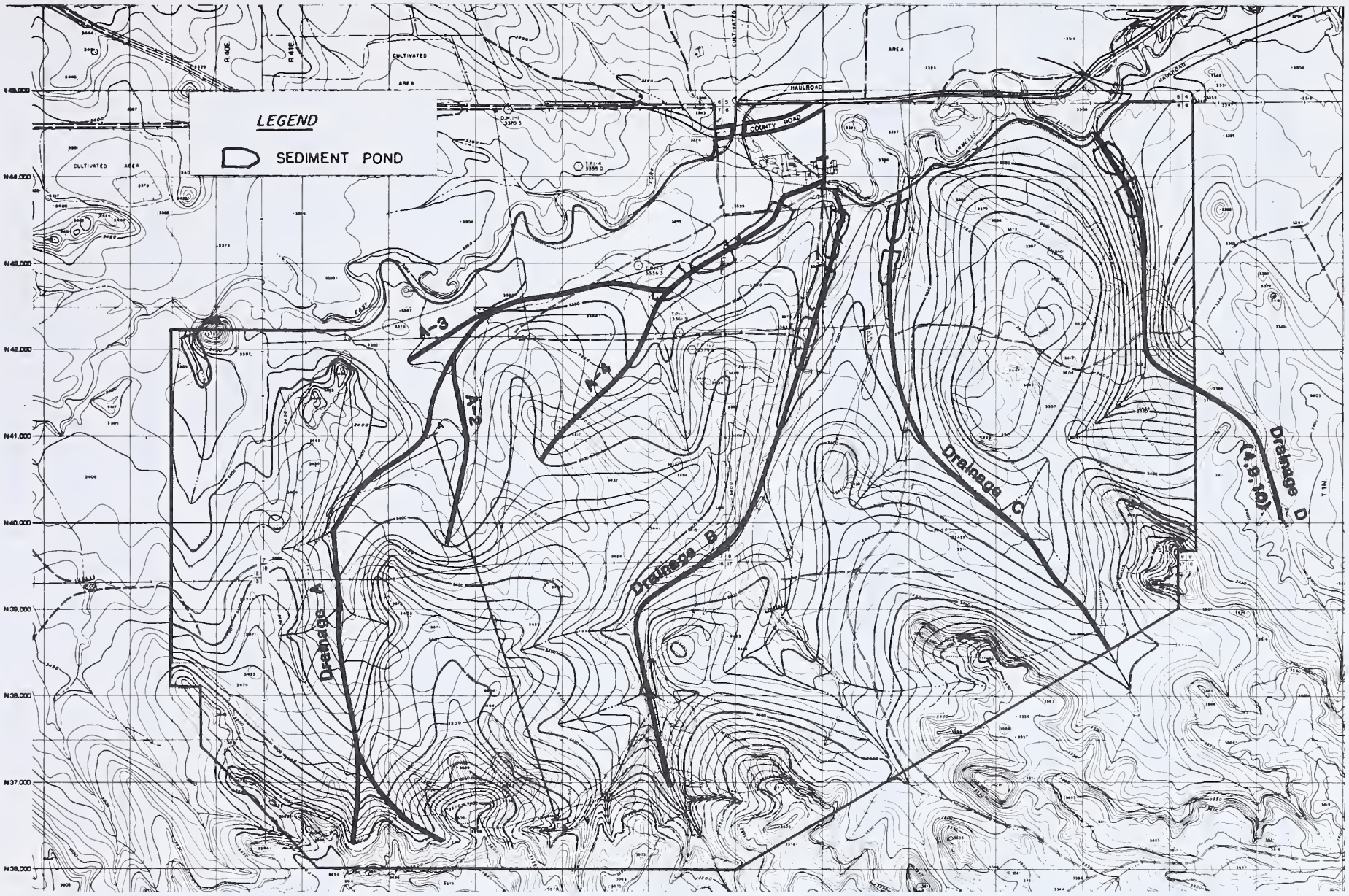


FIGURE I-6--Pre- and Postmining Topography of Area B
(The postmining topography is shown by the darker lines.)

To prepare the seedbed, Western Energy would first fertilize the soil. Then the company would rip, chisel, and disc the soil as necessary. A permanent, diverse plant cover of predominantly native species of grasses, forbs, shrubs, and trees would then be planted in proportions similar to those which existed before mining. Western Energy would use broadcast seeding, drill seeding, transplants, sod plugs, and other methods to establish the vegetative cover. On slopes that are greater than 10:1 (10 percent), the company would apply mulch to control erosion, promote germination of seeds, and increase the moisture retention of the soil. The amount of acreage Western Energy would reclaim each year would be about the same as the amount of acreage disturbed during the year.

Reclamation of the permit area would return the mined lands to rangeland for use by livestock and wildlife. Western Energy would manage the land primarily using a deferred-rotation grazing system, implemented at the end of the revegetated land's third growing season. Western Energy proposes to reestablish wildlife habitat within the mining area to conditions similar to or better than those that existed prior to mining.

Chapter II

DESCRIPTION OF THE EXISTING ENVIRONMENT

An analysis of the extension of Area B into sections 7, 8, 17, 18, 12, and 13 requires that this EIS cover 16 subjects, representing the "environment" of Area B. This environment encompasses the resources, enterprises, services, facilities, and people that could be affected by the project. This chapter presents the condition of the Area B environment today.

The reader is reminded that a great deal of information has been summarized in making this chapter. For additional information, refer to the Montco Mine EIS or the Rosebud Mine Comprehensive Environmental Impact Study, both published since 1982.

GEOLOGY

Topography and Geomorphology

The topography and geomorphology of Area B are typical of southeastern Montana. Here, as elsewhere, wide valleys are separated by bedrock ridges and breaks. The East Fork of Armells Creek, the major drainage dissecting the Rosebud Mine, marks the northern border of the Area B permit area. Five ephemeral streams (which flow only in response to snowmelt and intense rainstorms) drain northward across Area B, emptying into the East Fork of Armells Creek.

All five ephemeral drainages are less than 1½ miles long. They are distinguished by three well-defined reaches: an upper reach with steep headwaters and a well-defined channel; a middle reach with a poorly defined channel on low angle valley-fill deposits; and a lower reach with a well-defined incised channel (near the confluence with the East Fork of Armells Creek).

Area B rises steadily to the south. (See fig. I-6.) The elevation adjacent to the East Fork of Armells Creek is about 3,300 feet; the ridgetop (southern edge of permit area) separating the East Fork of Armells Creek from Emile and Miller Coulees located to the south reaches over 3,600 feet. Most of the uplands are steep, averaging about 15 to 20 degrees, while lands close to the East Fork of Armells Creek are generally flat (2-4 degrees).

No studies dealing specifically with rates of erosion have been completed for Area B. Based on vegetative cover and soil types, erosion rates in Area B

are probably low to moderate. Severe erosion areas have not been identified in the permit area.

Stratigraphy

The geologic units that make up Area B include stream-laid deposits of the East Fork of Armells Creek and its tributaries (alluvium), weathered bedrock and slope-wash deposits (colluvium), and bedrock. Bedrock underlying Area B is composed of sandstone, siltstone, shale, and coal deposits of the Tongue River Member of the Fort Union Formation.

The Rosebud coal seam in Area B is covered by an average of 120 feet of overburden bedrock, composed predominantly of fine- to medium-grained silty sandstone with some interbedded siltstone and shale deposits (Western Energy Area B permit application, 1981, p. 1205). Between the Rosebud and McKay coal seams lie 10 to 100 feet of interburden. The interburden varies in composition, ranging from sandstone to siltstone to shale over very short vertical and horizontal distances. In some areas the interburden is up to 60 percent sandstone, but generally siltstone and shale deposits dominate.

Immediately above and below both the Rosebud and McKay coal seams lie a minimum of 5 feet of shale. The shale tends to limit vertical ground water interchange between stratigraphic units and is responsible for the confined ground water conditions of the coal seam aquifers.

Overburden

Physical and chemical properties of the overburden can affect postmining vegetation and ground water quality because overburden material (called spoil once excavated) is placed back into the pit created by mining. Both salt lenses in the overburden and weathering of replaced overburden can, for example, add dissolved constituents to ground water passing through mine spoil. (See Hydrology, Ground Water.)

In the Area B extension, the electrical conductivity (EC) values (a measure of salinity) for the overburden average 1.66 millimhos per centimeter (mmhos/cm), and range from 0.6 to 3.8 mmhos/cm. (See table II-1.) The extension area as a whole has lower EC values than most of the Rosebud and Big Sky mine areas (Montana Department of State Lands and Office of Surface Mining, 1982, p. II-7; Montana Department of State Lands, 1980, p. II-2; U.S. Department of the Interior and Montana Department of State Lands, 1978, p. II-3). Electrical conductivity (EC) and sodium adsorption ratio (SAR; a measure of sodium content) values for Area B are low.

Heavy metals in the overburden generally do not reach high enough levels to make ground water unusable for stock watering or domestic purposes, although Area B does have unusally high zinc and nickel values. (See table II-1.) The elevated zinc values are attributed to drilling lubricants that have contaminated drilling samples. (See chapter III, Geology, Overburden.)

TABLE II-1
Weighted Averages of Overburden Physiochemical Characteristics for Each Drill Core
Taken from Sections 7, 8, 17, and 18 of Area B

Drill Core Number	Saturation Percent	pH	EC mmhos/cm	SAR	Sand	Silt	Clay	Texture*
					Percent			
N38E40	34.9	7.8	3.3	2.0	64.7	21.4	13.9	SL
N38E42	34.4	7.8	1.8	2.1	75.5	15.2	9.3	SL
N39E39	37.9	7.8	3.0	1.8	49.6	27.8	22.6	SCL
N39E41	33.0	8.2	1.2	1.7	87.4	7.8	4.8	S
N39E42	34.0	8.1	0.9	2.4	60.8	20.5	18.7	SL
N39E43	36.8	7.8	1.9	2.8	68.9	18.0	13.1	SL
N40E39	34.4	8.0	1.3	1.9	60.5	27.3	12.2	SL
N40E41	34.0	8.0	1.5	3.0	85.2	8.6	6.2	LS
N40E42	33.5	7.9	1.3	1.3	77.8	12.7	9.5	SL
N40E43	35.0	8.1	1.3	1.6	76.9	11.6	11.5	SL
N40E45	31.0	8.0	1.5	1.1	68.1	22.8	9.1	SL
N41E40	38.4	7.7	3.4	4.7	71.2	19.7	9.1	SL
N41E44	36.6	7.9	0.7	0.6	61.8	22.1	16.1	SL
N41E46	33.6	8.1	1.5	1.5	52.2	30.4	17.4	SL
N41E47	34.5	8.1	0.6	1.3	62.4	23.5	14.1	SL
N42E42	37.2	8.2	1.5	2.1	59.5	26.1	14.4	SL
N42E43	37.2	8.2	1.2	1.0	37.4	39.9	22.7	L
N42E45	43.1	7.8	3.8	1.4	46.0	23.7	30.3	SCL
N42E46	39.4	7.9	2.6	1.4	40.8	38.8	20.4	L
N42E48	40.2	8.1	0.7	0.6	51.4	27.9	20.7	L
N43E45	33.8	7.9	0.6	0.4	54.5	25.2	20.3	SCL
N43E46	33.9	7.5	0.9	0.5	53.6	27.3	19.1	SL
N43E47	36.2	8.0	0.9	0.8	64.9	23.9	11.2	SL
N43E49	46.1	8.0	3.1	0.9	32.5	39.6	27.9	CL
N44E47	42.2	8.1	1.2	1.4	26.2	51.4	22.4	SiL
N44E48	43.4	8.1	1.4	1.3	29.1	49.7	21.2	L

TABLE II-1 (continued)
Weighted Averages of Overburden Physiochemical Characteristics for Each Drill Core
Taken From Sections 7, 8, 17, and 18 of Area B

Drill Core Number	NO_3-N**	NH_4-N	P**	K	B**	Se**	Mo**	Hg	Zn	Fe	Mn	Cu	Cd**	Pb	Ni
	parts per million														
N38E40	8.9	7.2	1.5	90.0	0.5	0.02	0.2	0.06	103.9	40.9	15.8	0.8	0.02	1.2	0.5
N38E42	0.9	3.5	0.2	52.1	0.3	0.02	0.2	0.03	155.4	20.5	9.6	0.3	0.03	1.0	0.3
N39E39	9.7	3.7	0.6	81.3	0.5	0.02	0.2	0.06	85.4	31.7	16.3	0.9	0.02	1.7	0.7
N39E41	1.1	2.3	0.1	23.8	0.3	0.02	0.2	0.05	61.6	7.3	9.0	0.2	0.01	1.1	0.2
N39E42	0.4	2.2	0.6	87.4	0.7	0.02	0.2	0.06	74.1	80.3	37.2	0.5	0.03	1.4	0.6
N39E43	0.8	2.3	0.6	80.7	1.0	0.02	0.2	0.07	125.4	16.8	8.6	0.3	0.03	0.9	0.5
N40E39	0.6	1.9	0.3	74.3	0.7	0.02	0.2	0.06	106.0	40.8	22.2	0.6	0.02	1.8	0.6
N40E41	0.9	1.7	0.3	40.8	0.7	0.02	0.7	0.06	64.6	20.4	11.8	0.3	0.03	0.8	0.4
N40E42	0.7	2.0	0.2	74.9	0.6	0.02	0.2	0.05	147.4	54.8	19.0	0.4	0.04	1.2	0.3
N40E43	0.6	1.6	0.1	54.0	0.7	0.02	0.2	0.05	95.3	27.4	10.3	0.3	0.02	0.9	0.3
N40E45	1.7	3.1	0.5	76.8	0.3	0.03	0.3	0.06	27.0	35.5	11.3	0.9	0.04	2.0	0.9
N41E40	1.7	2.2	1.2	71.3	1.0	0.02	0.2	0.05	72.5	47.9	9.3	0.6	0.03	1.3	0.5
N41E44	2.0	8.6	0.4	65.5	0.6	0.02	0.4	0.11	70.9	98.0	16.1	0.6	0.06	2.1	0.8
N41E46	0.3	3.5	0.5	84.3	0.2	0.03	0.3	0.05	21.5	53.7	7.5	2.2	0.03	4.0	1.8
N41E47	0.6	5.6	1.2	87.4	0.3	0.03	0.3	0.05	4.0	42.8	12.1	1.4	0.01	2.6	1.1
N42E42	0.9	2.3	0.5	82.0	0.6	0.02	0.2	0.05	184.6	24.4	19.9	0.8	0.04	2.2	0.9
N42E43	0.6	2.2	0.6	83.0	0.6	0.02	0.2	0.04	63.7	17.3	4.4	0.7	0.02	1.3	0.2
N42E45	0.4	4.7	0.8	81.0	0.3	0.02	0.4	0.04	12.9	21.1	6.8	3.0	0.04	2.6	1.1
N42E46	0.5	4.8	0.5	77.5	0.1	0.03	0.2	0.05	26.7	41.9	9.0	2.1	0.02	3.3	1.4
N42E48	0.5	6.4	0.5	95.5	0.1	0.02	0.2	0.04	6.7	30.3	9.2	1.8	0.02	3.3	1.5
N43E45	0.1	3.2	0.5	51.2	0.1	0.02	0.2	0.04	5.9	20.8	7.3	2.7	0.03	2.6	0.8
N43E46	0.3	7.2	0.5	68.1	0.1	0.02	0.2	0.04	7.2	51.6	36.8	2.2	0.03	3.2	1.6
N43E47	0.3	3.8	0.7	97.1	0.6	0.04	0.3	0.05	39.9	47.8	13.5	1.9	0.09	3.6	1.2
N43E49	0.3	5.1	1.2	114.6	0.3	0.02	0.3	0.06	8.3	36.5	11.2	1.7	0.05	3.6	1.5
N44E47	0.3	5.1	0.5	107.3	0.1	0.04	0.3	0.08	3.4	48.4	12.8	2.6	0.03	4.8	1.5
N44E48	0.3	5.4	0.7	93.1	0.3	0.02	0.6	0.05	21.3	29.7	16.0	2.3	0.10	4.0	1.4

* S = Sand, LS = Loamy Sand, SL = Sandy Loam, L = Loam, SiL = Silt Loam, SCL = Sandy Clay Loam, CL = Clay Loam, SiCL = Silty Clay Loam, SiC = Silty Clay, SC = Sandy Clay, C = Clay.

**Many sample values were reported as less than the indicated minimum (detection limit) for these elements; however, averages [illegible] by dropping the less than sign.

Structure and Geologic Hazards

The shallow bedrock underlying Area B dips gently (1 to 2 percent) to the east southeast (Western Energy Permit Area B, sections 7, 8, 17, 18 permit application, 1982). No major faults or flexures are apparent from the 26 drill holes completed in the overburden of the Area B extension.

No known geologic features (active faults, landslides, etc.) pose a hazard to human life or property within the Colstrip region . The eastern quarter of the State, of which Colstrip is a part, has experienced very few earthquakes in the last century (Witkin, 1975). The strongest ground shaking, recorded in the eastern quarter of the State, registered V on the modified Mercalli scale (Hebgen Lake earthquake, 1959). It was felt by most people, breaking some dishes and windows, but did not structurally damage buildings (Qamer and Breuninger, 1979, p. 7).

HYDROLOGY

Ground Water in the Colstrip Area

Water-bearing strata near the surface at the Rosebud Mine include Rosebud spoil (replaced overburden), valley fill material, Rosebud overburden, Rosebud coal, Rosebud-McKay interburden, McKay coal, and sub-McKay strata. In the Colstrip area, most ground water use is devoted to stock watering (see table II-2) and most ground water is withdrawn from the sub-McKay strata (see table II-3).

Table II-2
Ground Water Uses in the Colstrip Area

[Source: Western Energy Company, 1980]

Use	Percent of Total
Stock	81%
House (domestic)	8%
Public (domestic)	3%
Irrigation	2%
Fire	0.5%
Industrial	0.5%
Unused	5%

Table II-3
Sources of Ground Water in the Colstrip Area

[Source: Western Energy Company, 1980]

Source	Percent of Total
Sub-McKay sandstone	46%
Rosebud Overburden	13%
Rosebud coal	8%
Alluvium	7%
McKay coal	3%
Tullock Formation	2%
Hell Creek Formation	1%
Rosebud Clinker	0.5%
Madison Formation	0.5%
Unknown	19%

Water for the Colstrip townsite and power plants is piped in from the Yellowstone River, although the community has three back-up wells completed in the sub-McKay. Water for mine operations, such as haul-road watering, comes from pit inflow and surface runoff.

The hydraulic properties of the water-bearing strata in Colstrip are summarized in table II-4. The water quality properties are summarized in table II-5. Figures II-1 and II-2 show the direction of ground water movement in the Rosebud and McKay coal seams.

Mineralization of water from springs and wells in the Colstrip area varies greatly. Almost all ground water and springs are suitable for stock watering. Ground water with dissolved solids below the recommended drinking water standard for total dissolved solids (500 mg/1 [milligrams per liter]) has been found in Area B, but is uncommon in the region. Ground water containing up to 1,500 mg/1 total dissolved solids (TDS) can be, and often is, used for drinking water in southeastern Montana, because better water sources are lacking. Generally, alluvial ground water from the East Fork of Armells Creek and other creeks surrounding the Rosebud Mine is too high in TDS for either sprinkler irrigation or for domestic use.

Mining has modified ground water flow directions up to a mile from the mine. Near active mine areas, Rosebud coal and Rosebud overburden ground water flows into open pits, lowering ground water elevations (potentiometric levels) around the mine. Dollhopf et al. (1979, p. 32) report drawdown in a well located over one-half mile upgradient of the active mine pit in section 3 of Area B. Van Voast et al. (1977) report no detectable drawdown in wells located one and one-half mile downgradient (east) of Peabody Coal Company's Big Sky Mine. The greatest drawdown occurs adjacent to pits, reaching 80 feet next to Area B (MDSL and OSM, 1982, fig. 3.2-5).

At present, the direction of ground water flow and degree of saturation of spoil at the Rosebud Mine varies widely. This is in part because mine pits lower water levels in reclaimed spoil, and this tends to limit spoil water movement. (See fig. II-3.) In Area E, for example, spoil water appears to move primarily toward the mine pit, although some water may move toward Cow Creek. Similarly, in sections 3 and 4 of Area B, most water seems to flow to the pit, although water may also leak downward into lower strata in section 3. In reclaimed spoil of Area A, in contrast, ground water levels have reestablished, connecting upgradient Rosebud coal ground water with East Fork of Armells Creek alluvial water. (See fig. II-3.) In Pit 6, where there is no mining, spoil water moves toward the South Fork of Cow Creek and Hay Coulee (at the southern edge of Pit 6). Ground water in spoil located north of Area D also appears to be moving toward the Cow Creek drainage.

TDS concentrations in 32 spoil wells range from 1,044 to 6,710 mg/1 and average 2,900 mg/1. Spoil water on the average contains 50 percent more TDS than the mined-out Rosebud coal seam ground water and 130 percent more TDS than the original Rosebud overburden ground water. Spoil levels of calcium, magnesium, sodium, bicarbonate, sulfate, and chloride (which in part make up TDS) rise in proportions similar to TDS levels (MDSL and OSM, 1983, Appendix B). The pH of spoil water, ranging from about 6.8 to 7.8, is slightly lower

TABLE II-4
Ground Water Flow in the Colstrip Area

Water-bearing Strata	No. of Wells	Transmissivity (gal/day/ft) Range	Transmissivity (gal/day/ft) Median	Flow Rate Through Area[1] gpm	Flow Direction
East Fork Armells Creek (valley fill)					
Rosebud Mine	25	6-74,800	9,900	40-60	Same general direction
Area B Extension	-	-	-	40-60	as creek, east and north
Spoil					
Rosebud Mine	17	0.2-23,400	61	Unknown	Variable
Area B Extension	None	-	-	-	--
Rosebud Overburden					
Rosebud Mine	23	1-79,000	57	Unknown	Variable
Area B Extension	10	1-65,300	528	15-50	Northeast
Rosebud Coal Seam					
Study Area[2]	35	3-12,700	30	10-40	Primarily east and toward
Rosebud Mine	19	3-1,200	130	10-20	East Fork of Armells Creek
Area B Extension	3	15-560	75	1-3	East and Southeast
Rosebud/McKay Interburden					
Rosebud Mine	11	1.0-20	6	0.5	East and southeast
Area B Extension				0.2	East and Southeast
McKay Coal Seam					
Rosebud Mine	19	1-1,410	7	5-10	East and southeast
Area B Extension	3	67-180	9	0.3-3	East and southeast
Sub-McKay[3]					
Rosebud Mine	6	90-3,200	470	35	East and southeast
Area B Extension	-	-	-	-	-

[1] Flow estimates are not precise. The rate of flow depends on the transmissivity (T) values chosen. The range of T values of the various aquifers often differed by several orders of magnitude. The flow values listed are estimates based generally on median T values.

[2] Study Area--270-square-mile area encompassing entire Rosebud and Peabody Mines. (See Montana Department of State Lands and Office of Surface Mining, 1983b, fig. II-3.)

[3] Strata below McKay coal seam but above Lebo Shale.

TABLE II-5
Ground Water Quality in Colstrip Area
(total dissolved solids in mg/l)

Water-bearing strata	No. of Wells	Range	Average
East Fork Armells Creek			
Rosebud Mine	40	1,340-5,160	2,770
Spoil			
Rosebud Mine	32	1,044-6,710	2,902
Rosebud Overburden			
Rosebud Mine	22	335-3,098	1,246
Area B Extension	6	354-810	670
Rosebud Coal			
Rosebud Mine	55	334-6,520	1,888
Area B Extension	6	343-2,297	1,244
Rosebud/McKay Interburden			
Rosebud Mine	15	538-3,590	1,770
Area B Extension	2	684-2,537	1,610
McKay Coal			
Rosebud Mine	42	546-9,843	2,295
Area B Extension	5	721-2,500	1,309
Sub-McKay			
Rosebud Mine	19	890-3,320	1,706
Area B Extension (within one mile)	4	890-2,000	1,350

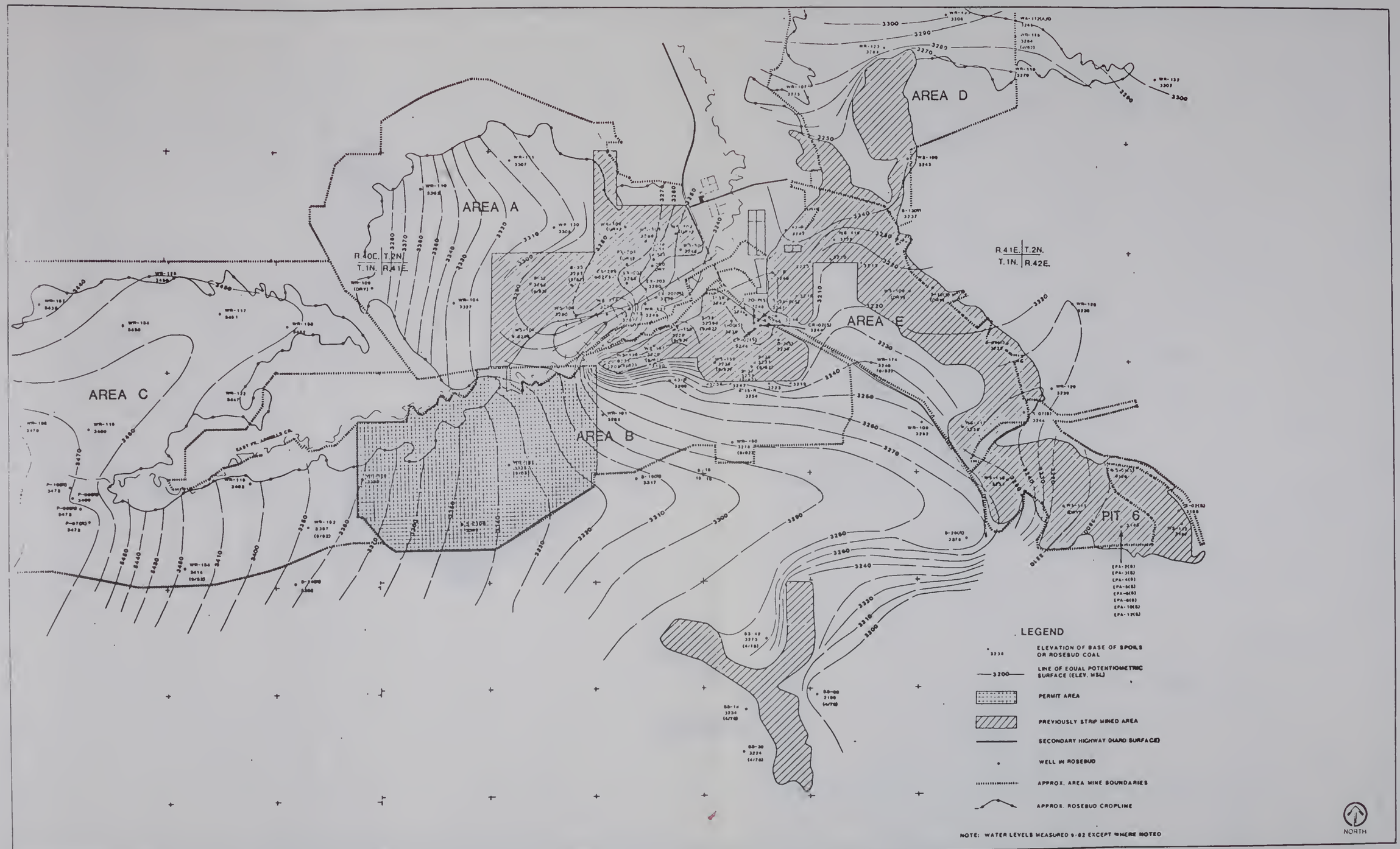


Figure II-1

Regional Ground Water Elevations (Potentiometric Surface) of Rosebud Coal Aquifer

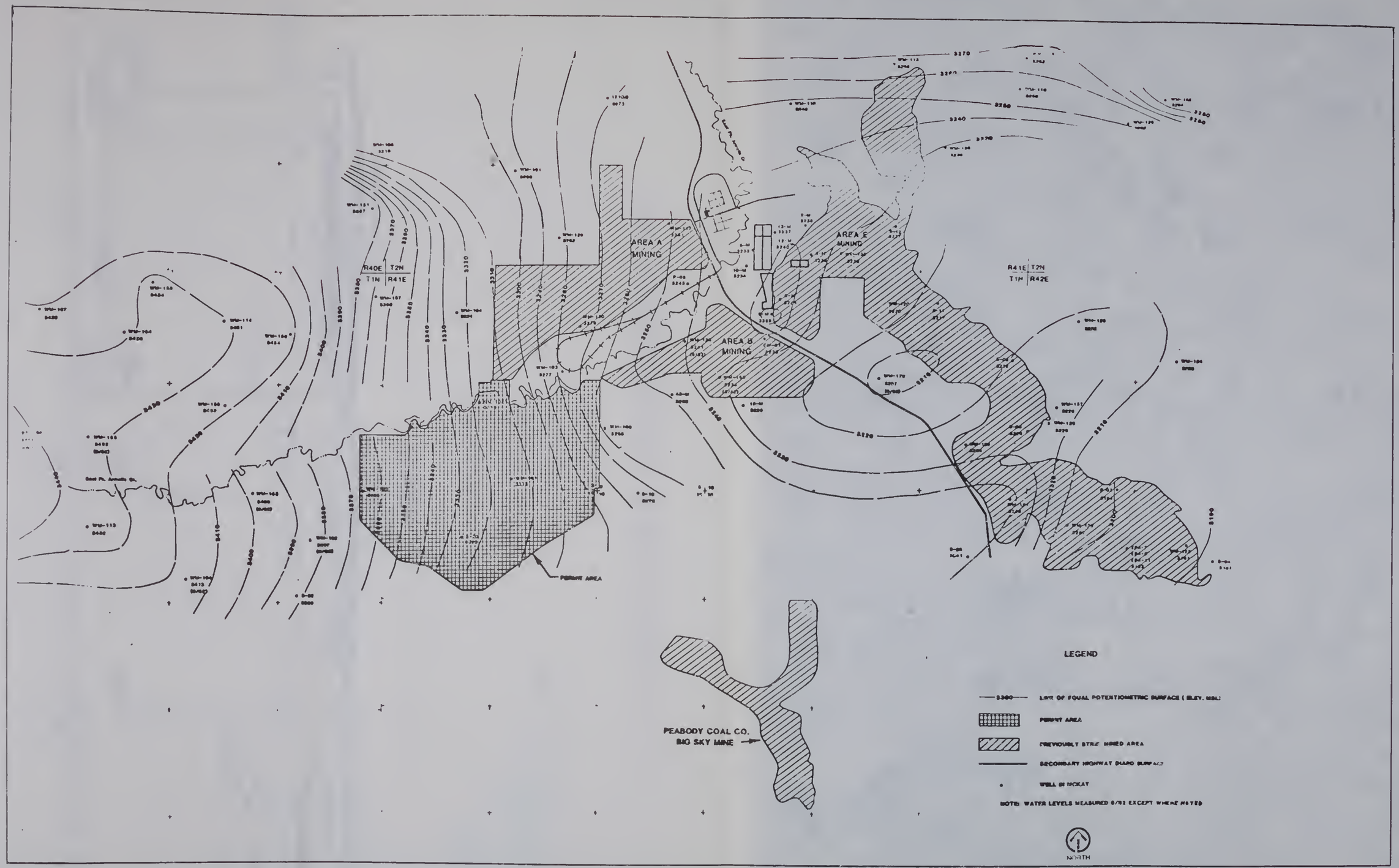
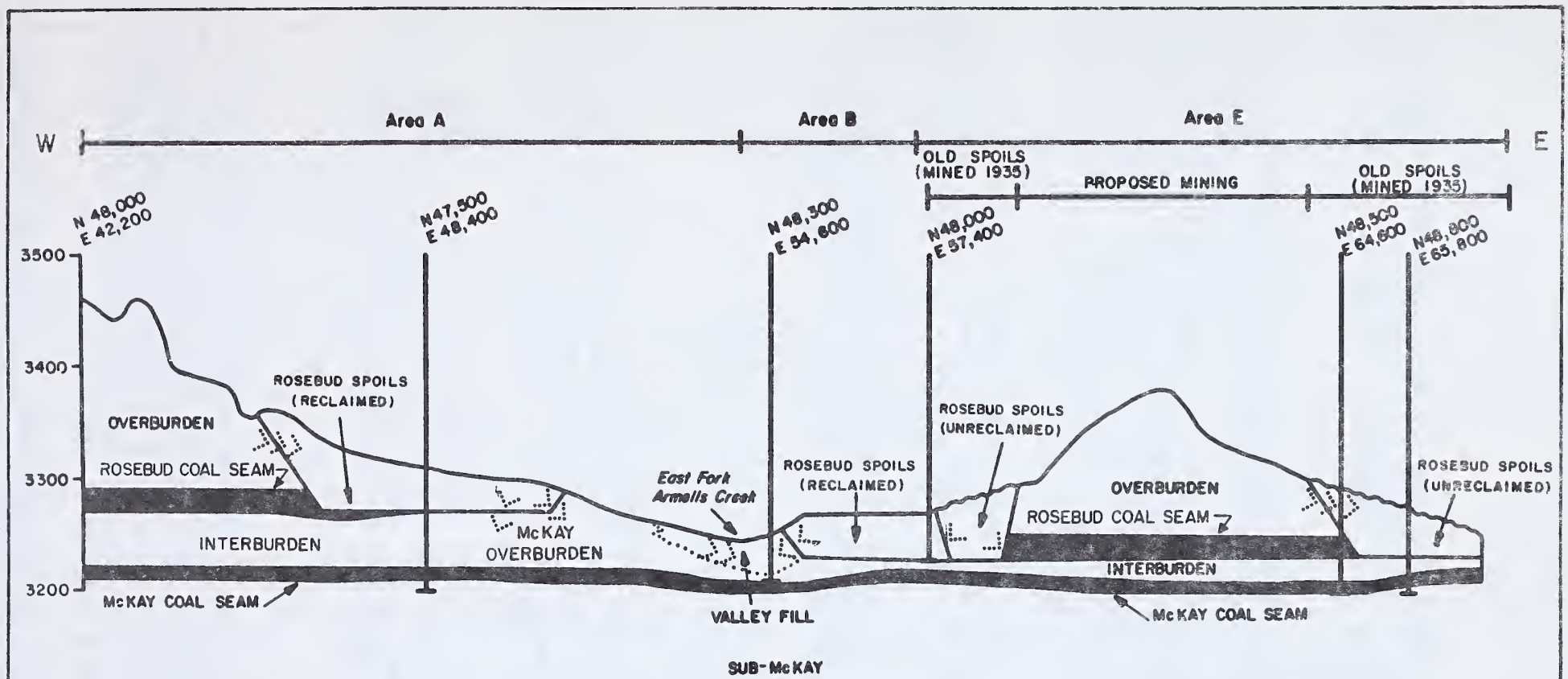


Figure II-2

Regional Ground Water Elevations (Potentiometric Surface) of McKay Coal Seam



LEGEND

HORIZONTAL SCALE: 1"= 2790'

VERTICAL SCALE: 1"= 143'

VERTICAL EXAGGERATION: 20X

DIRECTION OF GROUNDWATER MOVEMENT

FIGURE II-3--Schematic Cross Section of Ground Water Movement Through Spoil and Surrounding Material, Rosebud Mine Area, Montana

than overburden water, which ranges from 7.2 to 8.4. Iron concentrations in spoil water are also slightly lower, manganese slightly higher, and other trace elements about the same as in overburden water (MDSL and OSM, 1983a, section 2.2.1.3.2).

Spoil water of this quality can generally be used for watering of horses and cattle, although a period of adjustment may be necessary. Horses can safely drink water containing TDS levels up to 6,400 mg/l and cattle between 7,000 (dairy) and 10,000 (beef) mg/l TDS levels. Livestock using water with such high concentrations may have to drink more often and may suffer diarrhea for a few days until adjusted. Adverse physiological effects or weight losses have not been reported at lower TDS concentrations (McKee and Wolf, 1971, and National Academy of Sciences, 1974, p. 39). Spoil water is generally be unfit for poultry, swine, sprinkler irrigation, or domestic use.

Alluvial ground water in the headwaters of Cow Creek, next to Area E, has elevated TDS values. An estimated 5 to 25 percent increase in TDS concentrations, from roughly 4,000 mg/l to 5,000 mg/l, probably stems from old Northern Pacific spoil water seepage (MDSL and OSM, 1982, Section 3.2.1.1.2, Valley Fill). Raised TDS levels in the South Fork of Cow Creek near Pit 6, where well S-05 averaged 5,300 mg/l TDS, also probably stem from Northern Pacific spoil, although the amount of flow in this area appears to be very small.

Water-Bearing Strata of Area B Extension

Valley Fill Ground Water

The valley fill of ephemeral creeks in Area B cannot transport as much ground water as the lower gravel units of the East Fork of Armells Creek. The amount of water in the ephemeral units varies with the season. During spring the ephemeral valley fill units can carry 5 to 10 gallons per minute (gpm); by late summer or fall, the units usually dry up.

The valley fill of the East Fork of Armells Creek borders the northern limit of Area B. The coarse lower gravels of the valley fill transmit 40 to 60 gpm in this reach. Ground water levels in the alluvium of East Fork Armells Creek fluctuate less than tributary alluvial ground water levels.

Overburden Ground Water

The overburden in section 8 of the extension carries more ground water than most of the overburden elsewhere in the Colstrip region. Ten wells were drilled in the overburden and alluvium in the northeast corner of section 8 to determine the source of water feeding a spring in a tributary of the East Fork of Armells Creek. (See fig. II-4.) Based on aquifer tests, the overburden in the northwest corner of Section 8 carries at least 10 to 20 gpm.

The original source of this overburden water is believed to be alluvial ground water of a small creek that flows north across Area B. (See fig. II-4.) The alluvial water is lost to the sandstone lenses within the

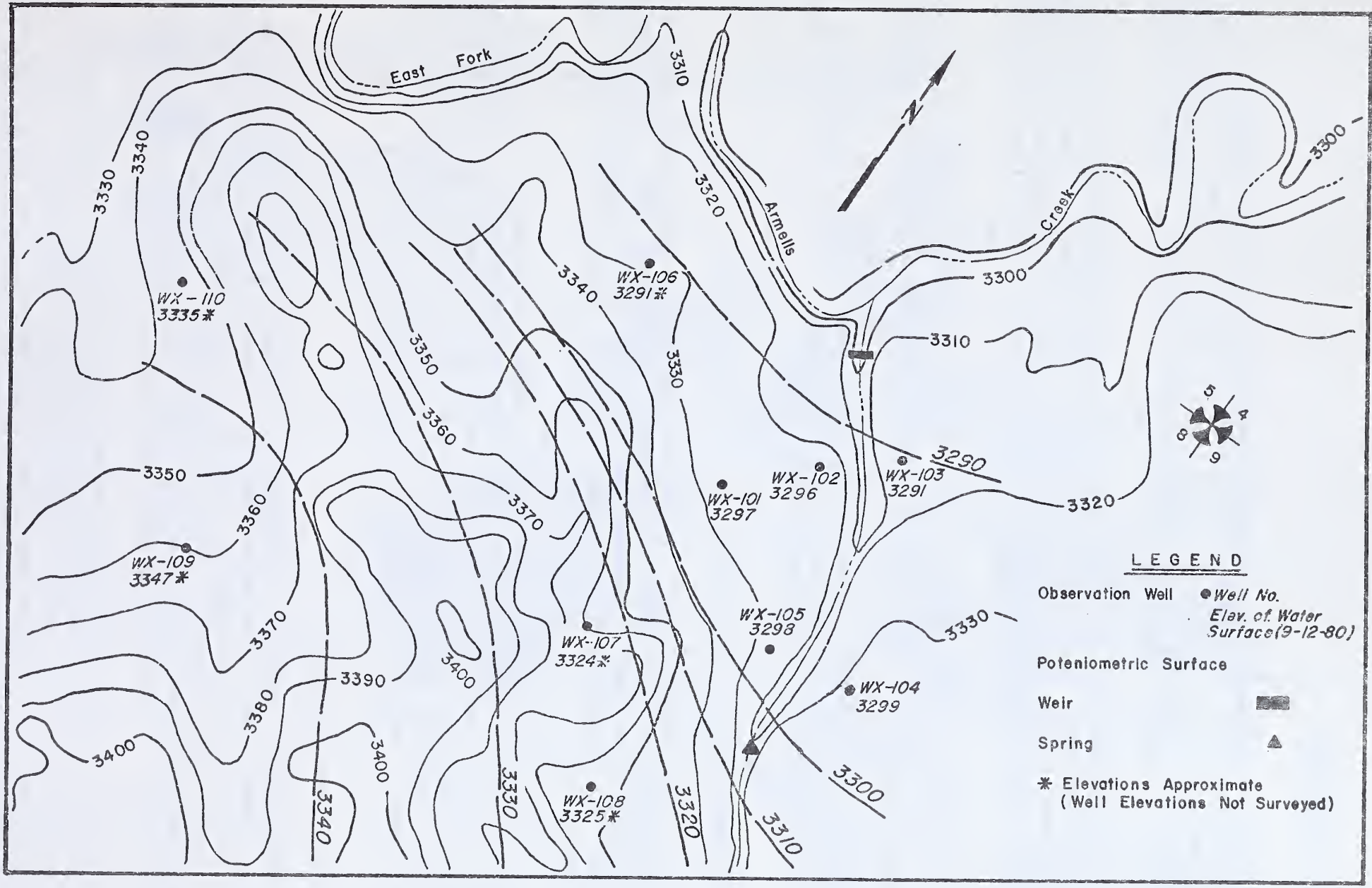


FIGURE II-4--Observation Wells and Ground Water Elevations of Tributary Alluvium and Rosebud Overburden in Area B (Section 8)

underlying overburden. The sandstone lenses in turn carry the water to the ephemeral draw in the northwest corner of section 8. Some of this ground water surfaces as a spring, discharging 5 to 10 gpm. The rest of the water seeps into the alluvium of the ephemeral draw, eventually adding to ground water flow of the East Fork of Armells Creek.

No hydrologic monitoring wells outside the northeast corner of section 8 have been developed in the Area B extension. As a result, how much ground water passes through the remainder of Area B is unknown. Based on the average overburden characteristics of the Colstrip region, the total flow through the remaining two thirds of Area B is probably less than 5 gpm.

The quality of overburden ground water in section 8 is very good--suitable for drinking water (500 mg/l TDS), although sometimes slightly above the recommended standard. Total dissolved solids average 670 mg/l, ranging from 354 mg/l to 810 mg/l for the six overburden wells near the spring. The quality of water in the tributary alluvium of the spring is similar (566 to 850 mg/l TDS). No overburden wells used for domestic or agricultural purposes lie within 1½ miles of the proposed permit area.

Rosebud Coal

Only about 1 to 3 gallons per minute flow through the entire 8,000-foot-wide section of Rosebud coal within the extension disturbance area. The water is of relatively good quality (averaging 1,240 mg/l TDS). This is better than the seam's water quality in the Rosebud Mine as a whole (1,888 mg/l TDS). (See table II-3.)

The east-west trending ridge within Area B that separates the East Fork of Armells Creek from Hay, Miller, and Lee Coulees also acts as a ground water divide. A small portion of the ground water in the Rosebud coal seam (about 0.6 percent of Area B, or 110 acres) flows toward the southeast and the Big Sky Mine. (See fig. II-5.) Most of the total flow in the Rosebud seam (1 to 3 gpm) flows to the East Fork of Armells Creek alluvium.

Other Water-Bearing Strata

The potentiometric surface of the McKay coal seam closely parallels, at a slightly deeper level, the potentiometric surface of the overlying Rosebud seam. (See fig. II-1.) Water in the McKay flows primarily east and northeast. Water quality appears to be better (averaging 1,300 mg/l TDS) than the average for the Rosebud Mine (2,300 mg/l TDS). Water flow is probably low--1 to 2 gallons per minute--through the Area B extension. (See table II-2.)

Flow in the Rosebud-McKay interburden closely parallels flow in the overlying Rosebud and underlying McKay seams. The quantity of flow in this unit appears to be small, less than 0.5 gpm through the entire Area B. The interburden of Area B is composed mostly of siltstone and shale, which have low permeabilities. Elsewhere in the Colstrip region (Area E and near Colstrip), higher flows through the interburden are likely. The quality of interburden

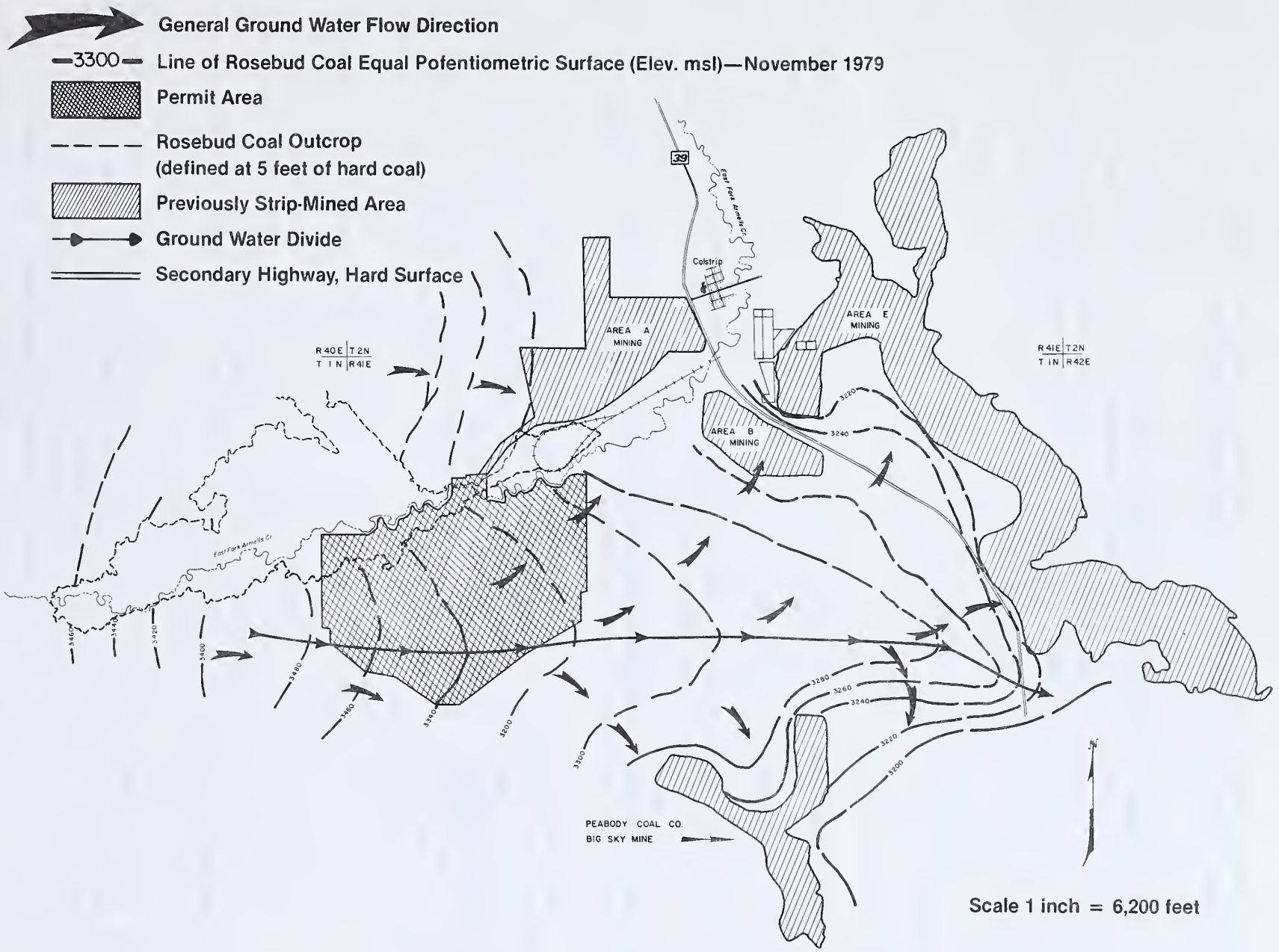


FIGURE II-5--Ground Water Elevations of Rosebud Coal Seam

water is not well characterized in Area B. Two wells completed had different TDS values: 684 and 2,537 mg/l. (See table II-3.)

The water level of only one of four wells drilled into the sub-McKay units near Area B has been tested. As a result, the direction of flow in this unit is difficult to characterize. Of nineteen wells drilled into the sub-McKay units throughout the Rosebud Mine, two located near Area B had the best water quality (890 and 946 mg/l TDS). The other two wells in Area B had water quality (1,556 and 2,000 mg/l TDS) closer to the average of the sub-McKay for the entire mine (1,706 mg/l TDS).

Surface Water

East Fork of Armells Creek

The Area B extension lies entirely within the East Fork of Armells Creek drainage. The permit area (1,820 acres) constitutes about 10 percent of the creek's drainage area above Area B.

Two stock and irrigation ponds impound all spring runoff in the East Fork of Armells Creek upstream of Area B, except during large flood events. Most of the creek above Colstrip is a losing stream; that is, surface water drains into the alluvium. Immediately above Colstrip, this process is reversed: the creek gains water from the underlying alluvium and becomes a perennial stream.

The Department of State Lands has determined that the East Fork of Armells Creek, between the western end of Area C and FAS 39, does not meet the criteria for designation as an alluvial valley floor. (See fig. II-5 for general location.) Sufficient water is not available to support agricultural activities through either flood irrigation or subirrigation. An alluvial valley floor decision has not been made, but will be, on the remainder of the creek above this area.

Based on preliminary information, the floodplain and lower terraces of the East Fork of Armells Creek 4 to 5 miles downstream of Colstrip appear to meet the criteria for an alluvial valley floor: the floodplains and terraces are underlain by alluvial material and are flood irrigated. The Department of State Lands has determined that the small changes in water quality and quantity caused by existing mining has not adversely affected downstream uses of surface waters (MDSL and OSM, 1982b).

Western Energy Company has constructed numerous ponds to retain runoff from disturbed areas at or within the Rosebud Mine. The ponds capture sediment-laden water, keeping the runoff from entering the East Fork of Armells Creek. All runoff up to a moderate rate (10-year, 24-hour event) is retained by the ponds. (Spillways are incorporated into the dams to allow for overflow.) By retaining almost all runoff from disturbed areas, peak flows in the East Fork of Armells Creek have been reduced. The loss of flood waters downstream of the mine has not adversely affected uses and might in fact lessen flood damage.

The surface water quality in the East Fork of Armells Creek varies. Total dissolved solids concentrations range from 200 mg/l during high flows to 6,500 mg/l during low flows. Most of the time, the East Fork averages about 3,000 to 4,500 mg/l, since low-flow conditions prevail. The poorest water quality (4,500 to 5,000 mg/l) usually occurs during late summer and early fall, due to water loss from evaporation and vegetation transpiration. The highest TDS concentrations found in the creek usually exceed, by 200 or 300 percent, those found in the valley fill and water-bearing bedrock strata (MDSL and OSM, 1982b, II-49).

Surface water in the East Fork of Armells Creek is used for stock watering and occasionally flood irrigation, both upstream and downstream of the Rosebud Mine. The creek's waters are not used for municipal or commercial purposes near Colstrip.

Rosebud Creek and its Tributaries

In the Rosebud mine area, ground water in the McKay coal seam and the sub-McKay primarily flows toward the small ephemeral tributaries of Rosebud Creek, mostly to Cow Creek. (See fig. II-2.) The ground water adds to surface flow of Cow Creek, most significantly during low flow.

The Cow Creek drainage, including the South Fork of Cow Creek, covers 29 square miles. Surface water flow fluctuates over the year with little or no surface water present from July through September.

The surface water quality of Cow Creek changes with location and time. In the headwaters, water quality is generally good, especially during high flow. As flow decreases, water quality in the upper reaches generally deteriorates. Subsurface water quality also deteriorates downstream. In the middle reach of Cow Creek, the U.S. Geological Survey has measured surface water TDS values for the last two years. The values have averaged 4,700 mg/l, ranging from 3,050 to 7,900--unfit for flood irrigation and occasionally for stock watering.

Area B extension

The spring in the northeast corner of section 8 adds to surface water flow near the mouth of one of the five ephemeral creeks in the Area B extension. The quality of spring-fed runoff is good (680 mg/l TDS). From 1971 to 1980, the peak weekly average flow for this particular ephemeral creek was 36 gpm, although the average flow was less than 5 gpm. The spring normally flows into the ephemeral drainage, but stopped in December, 1981, (Peter Norbeck, Western Energy Company, oral commun., August 1982) due to either a lack of precipitation or ground water drawdown from the Area B pit.

Surface water runoff is sporadic above the spring and in the ephemeral creeks draining Area B. The creeks normally flow only after intense thunderstorms and during rapid snowmelt. A crest gage, about 1,800 feet upstream of the mouth of the spring-fed tributary, recorded only three high flow events

(surface water runoff) in the 18 months since installation: 104, 3,300, and 1,500 gpm. The highest flow occurred during an August, 1981, thunderstorm. For the remainder of the year, the ephemeral creeks of Area B were probably dry.

Man-Induced Changes in Surface and Shallow Ground Water

Industrial, residential, and mining developments have changed the hydrologic system around Colstrip. The surge (water storage) pond for Yellowstone River water for Montana Power Company's Colstrip Units 1 and 2 leaks an estimated 175 acre-feet of water per year. This leakage, added to an estimated 50 acre-feet per year from other industrial ponds, amounts to about 140 gpm. The Colstrip sewage treatment plant discharges an additional 210 acre-feet per year (130 gpm) directly to the East Fork of Armells Creek.

The effect of this added water, primarily imported Yelowstone River water, is to raise ground water levels in the East Fork of Armells Creek alluvium and create perennial flow in the creek downstream of Colstrip. The raised alluvial ground water levels might contribute to the waterlogging of the irrigated hayfields located 4 to 7 miles downstream of Colstrip (J.R. Lee's Ranch).

The industrial activity near Colstrip has probably improved surface water quality in the East Fork of Armells Creek. The two largest contributors to the surface and alluvial ground water system of the creek are the sewage treatment plant discharge and leakage out of Montana Power Company's surge pond. Both sources have low average total dissolved levels (about 750 mg/l), which may dilute and improve the creek's surface water quality.

Seepage of mine spoil water into alluvial valley fill is suspected to have caused changes in alluvial ground water quality in localized headwater areas of the Cow Creek drainage (MDSL and OSM, 1983b). Concrete proof of the adverse effects on Cow Creek cannot be determined, because premining alluvial ground water quality data are not available. (Mining in the headwaters of Cow Creek was started by Northern Pacific in 1925.) Even so, mining may, at most, have increased TDS levels of alluvial ground water near the mine by 5 to 25 percent (MDSL and OSM, 1983).

The few wells in the Rosebud-McKay interburden that are located near mine areas do not show effects of mine spoil water, although spoil water probably has degraded the interburden water in localized areas. In contrast, interburden wells below the industrial ponds associated with Colstrip Power Units 1 and 2 have undergone marked increases in TDS levels due to downward seepage of pond water. (See MDSL and OSM, 1983b.)

Downward leakage of the mine spoil water into the McKay coal seam and the Rosebud-McKay interburden ground water is limited at present because of several factors: (1) under open mine pits ground water moves up, rather than down, as elsewhere in the Colstrip area, (2) the spoil are not fully saturated in many areas as they will be once mining stops in adjacent areas, and (3) some of the mine area contains shaley interburden, which would tend to limit

vertical leakage. In the future, spoil water will leak into underlying strata in places, eventually reaching the alluvium of Cow Creek and the East Fork Armells Creek, possibly increasing TDS levels near the mine. (See chapter III, Hydrology, Cumulative Hydrologic Effects of Mining Area B, Second Extension.)

The existing high TDS levels in alluvial ground water and in the surface waters of Cow Creek, especially near the mouth of the creek, are mainly a result of natural causes. Cow Creek has been the natural site of ground water discharges for tens of thousands of years. Dry land farming and flood irrigation of alfalfa fields within the Cow Creek drainage over the last 20 to 30 years may have added to the TDS loading in Cow Creek. The actual TDS contributions of mining, agriculture, and natural causes cannot be totally separated because of a lack of premining and preagricultural hydrologic data. Evaporation will naturally tend to concentrate TDS (salts) in the shallow alluvium and surface waters of an ephemeral stream like Cow Creek.

SOILS

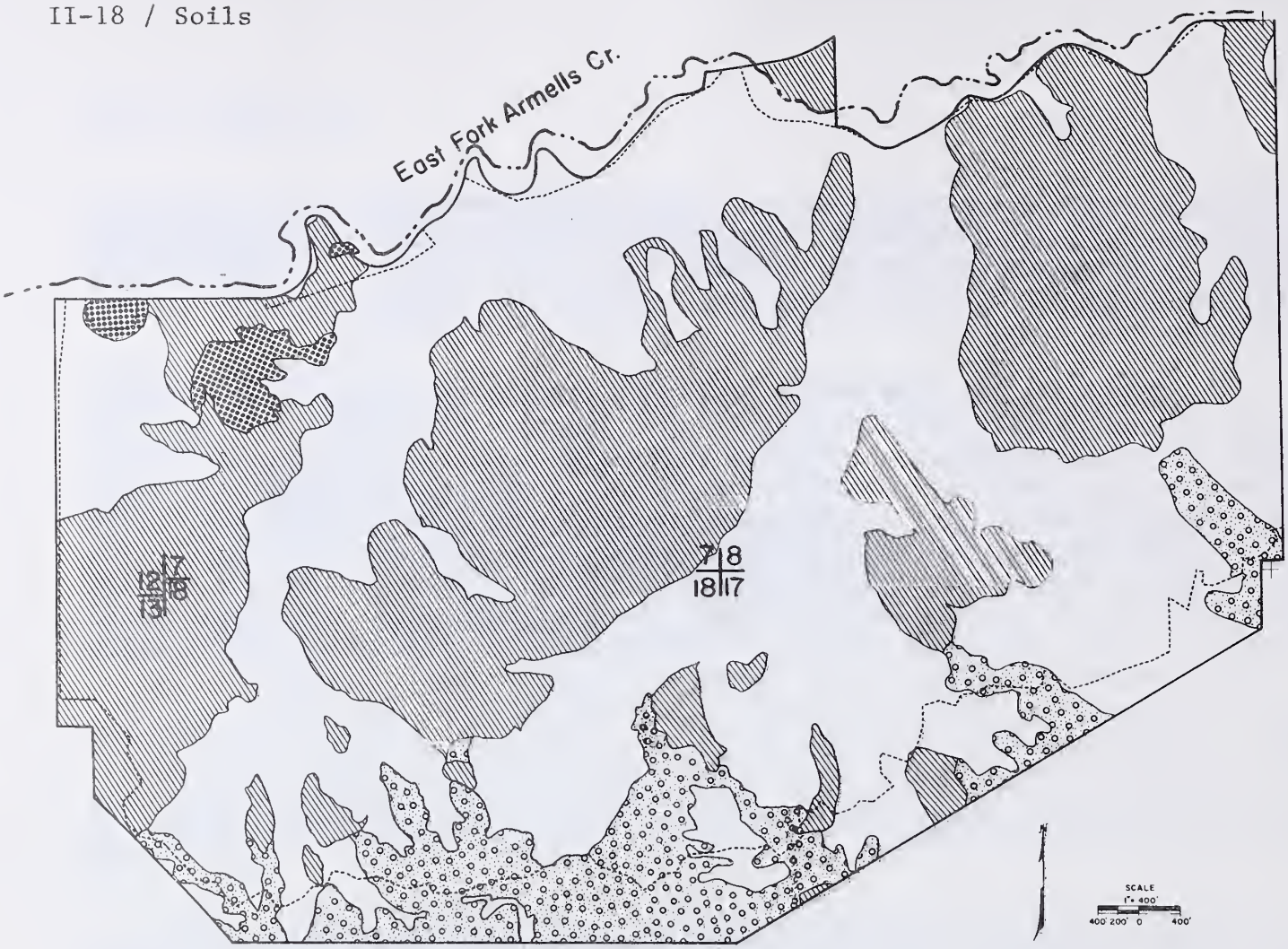
The proposed permit area consists mostly of soils with light-colored subsoils that lack pronounced layering and thin, dark-colored surface layers (Aridisols). Other, less common soils occurring in the area include soils with little alteration from underlying materials (Entisols) and moderately well-developed soils with thick, dark, enriched surface layers (Mollisols). Areas of rock outcrop lie near ridgetops in the southern part of the proposed permit area, most of which would not be disturbed by mining. Smaller areas of rock outcrops are found throughout the proposed permit area.

Seventeen soil series lie within the permit area, sixteen of which would be disturbed by mining. These soils can be grouped into the following four major soil types by similarities in texture, parent material, and topographical position. (See also fig. II-6.)

--Sandy residual and alluvial soils
--Loamy and clayey alluvial soils
--Unbaked shale and siltstone soils
--Baked shale and sandstone soils

Sandy Residual and Alluvial Soils

Soils in this group are formed in alluvium (sediment deposited by water) or valley fill material on uplands and in material weathered from sandstone. Lying between drainages, the group covers about 39 percent of the proposed 1,628-acre disturbance area, and consists primarily of the Busby and Reidel soil series, with minor inclusions. Small sandstone outcrops protrude throughout the group. Textures range from fine sandy loam to sandy loam at the surface and loamy fine sand to sandy loam in the subsoil. In soils on ridges and hilltops, soft sandstone often lies 2 feet or less below the surface.



Sandy Residual and Alluvial Soils

Loamy and Clayey Alluvial Soils

Unbaked Shale and Siltstone Soils

Baked Shale and Sandstone Soils

Permit Boundary

Disturbance Boundary

FIGURE II-6--Major Soil Groups of the Proposed Permit Area

Upland grassland, dominated by needle-and-thread and western wheatgrass, is the major vegetation type found in the group. A considerable amount of disturbed grassland--areas plowed and planted in the past with crested wheatgrass--also lies in the group. These soils are best suited for grazing, since low available water would limit crop production.

Loamy and Clayey Alluvial Soils

The soils in this group formed in deposits of loamy and clayey material at the base of hills and on terraces along drainages. The group, the most widespread in the Area B extension, covers about 55 percent of the proposed disturbance area. The group includes the Kremlin, Lonna, Yamac, Kobar, Vanstel, and Havre soil series, and portions of the Cooers series. This group also includes the undifferentiated unit referred to in the mapping as Ustic Torriorthents. Small, sparsely vegetated gumbo knobs with shale near the surface occur in parts of the group. At the surface, soil textures range from fine sandy loam to silty clay loam, with loam and silt loam being the textures most commonly encountered. Subsoil textures are commonly silty clay loams and silt loams, but can range from a fine sandy loam to clay loam. Commonly, 60 inches or more of these soils cover the underlying bedrock.

The major vegetation types found in the group are upland grassland and disturbed grassland, intermixed with small areas of silver sagebrush and big sagebrush. The group is well suited for grazing use and small grain production, owing to moderate water availability in the surface and subsurface layers, a critical requirement for crop growth.

Unbaked Shale and Siltstone Soils

Composed mostly of residual soils formed in place from weathered shale and siltstone, this group of soils varies widely. It is found on the steeper hills and ridges along the southern boundary of the proposed permit area (fig. II-6) and covers about 5 percent of the proposed disturbance area. Soil series include Yawdim, Delpoint, and Cabbart. Soils in the group are mostly shallow to moderately deep, with shale, siltstone, and some sandstone bedrock 12 to 30 inches below the surface. Rock fragments lie on the surface and throughout the profiles. Shale and sandstone outcrops and gumbo knobs occur in limited amounts throughout the group. Soil textures at the surface are loams to silty clay loams; subsoil textures are usually heavier, but range from silty clays to silt loams and loams.

The major vegetation type in the group is ponderosa pine-grassland, dominated by ponderosa pine, Rocky Mountain juniper, and bluebunch wheatgrass. The soils are best suited for grazing, because the complex, often rugged terrain precludes farming.

Baked Shale and Sandstone Soils

Soils in this group, sometimes called "scoria" or "clinker" soils, formed in material weathered from sandstone and shale baked by burning coal. Usually

reddish in color, the group covers uplands and footslopes in the northwest corner of the permit area (fig. II-6), making up less than 2 percent of the proposed disturbance area. This group includes the Birney, Kirby, and Spang series, and portions of the Cooers series.

Surface soil textures are usually gravelly and channery (containing flat fragments of sandstone and shale) loams or sandy loams, with subsoil textures ranging from sandy loam to very gravelly and channery loams. Most of the soils in the group have a high percentage of coarse fragments, especially in the subsoil layers.

The major vegetation types in the group are the ponderosa pine-grassland type and the skunkbush sumac type, with smaller areas of the upland grassland type found on the footslopes.

Baked shale and sandstone soils are best suited for limited grazing and wildlife habitat. In the Rosebud Mine area, these soils commonly support stands of ponderosa pine and Rocky Mountain juniper, both valuable wildlife species. Native shrubs and grasses grow well, although usually in less dense stands than other grassland and shrub areas, owing to shading by nearby trees and the abundance of rock fragments on the surface.

VEGETATION

The vegetation of the proposed permit area is typical of most of southeastern Montana. Cool-season perennial grasses dominate, intermixed with annual grasses, small patches of warm-season grasses, forbs, and various shrub communities. In the permit area, pine and juniper grow in colonies on upper slopes and ridges, mostly along the southern boundary. No threatened or endangered plant species have been identified in the area.

Vegetation Communities and Other Mapping Units

Vegetation studies divide the permit area into a number of plant communities, designated as "mapping units." Table II-6 lists the acreage of the mapping units (including two miscellaneous units), and gives the size of the units for both the entire permit area and the proposed disturbance area. Brief descriptions of the units follow:

Upland Grassland Unit

By far, the largest vegetation community in the Area B extension is upland grassland, making up about 70 percent of the area proposed for disturbance. Of the grasses, needle-and-thread (Stipa comata) and western wheatgrass (Agropyron smithii) dominate. Blue grama (Bouteloua gracilis) and prairie junegrass (Koelaria cristata) are also present in considerable amounts. Decreaser species (those that decrease in abundance under continued heavy use)

TABLE II-6

Vegetation Mapping Unit Acreages,
For the Area B Extension

	Mapping Unit Name	Permit Area	Disturbance Area
Vegetation Types:	Upland Grassland	1,196	1,133
	Big Sagebrush/ Grassland	145	108
	Silver Sagebrush/ Grassland	115	79
	Skunkbush Sumac/ Grassland	54	40
	Ponderosa Pine/ Grassland	61	27
	Gumbo Knob	14	10
	Creek Bottom	10	6
	Disturbed Grassland	229	219
Miscellaneous:	Corrals & Buildings	7	3
	Sandstone Outcrops	3	3
	TOTALS	1,820	1,627

include bluebunch wheatgrass (Agropyron spicatum), sand bluestem (Andropogon hallii), prairie sandreed (Calamovilfa longifolia), and green needlegrass (Stipa viridula), but their growth has apparently been suppressed by past overgrazing (ECON, 1980). Forb canopy coverage is dominated by false tarragon sagewort (Artemisia dracunculus). Other common forbs are fringed sagewort (Artemisia frigida), broom snakeweed (Gutierrezia sarothrae), Hoods phlox (Phlox hoodii), and scarlet globemallow (Sphaeralcea coccinea). Although occurring less frequently, three shrub species grow in the community: silver sagebrush (Artemisia cana), shrubby evening primrose (Oenothera serrulata), and prairie rose (Rosa arkansana).

Big Sagebrush/Grassland Unit

Big sagebrush/grassland, the largest shrub community, makes up about 7 percent of the proposed disturbance area. Of the shrubs, big sagebrush (Artemisia tridentata) dominates, growing with lesser amounts of silver sagebrush, shrubby evening primrose, and skunkbush sumac (Rhus trilobata). Grasses are dominated by bluebunch wheatgrass. A considerable amount of threadleaf sedge (Carex filifolia) is also present. Forb cover is low. Species include false tarragon sagewort, fringed sagewort, and Hoods phlox. Based on annual vegetative production, this is the most productive community in the proposed permit area.

Silver Sagebrush/Grassland Unit

This community, covering about 5 percent of the proposed disturbance area, is visually dominated by silver sagebrush. Other common shrubs include big sagebrush, shrubby evening primrose, prairie rose, and skunkbush sumac. Dominant grasses in the community are western wheatgrass and green needlegrass. Total forb coverage within the community exceeds all other communities in the permit area. Common forbs include western yarrow (Achillea millefolium), cudweed sagewort (Artemisia ludoviciana), broom snakeweed, Hoods phlox, and scarlet globemallow.

Skunkbush Sumac/Grassland Unit

This community covers about 2 percent of the proposed disturbance area. Skunkbush sumac is the most common of the shrubs, followed closely by silver sagebrush. Prairie rose and common snowberry (Symphoricarpus albus) are found in much lower densities. Needle-and-thread is the dominant grass, sharing its dominance with threadleaf sedge. Other common grasses in the community are western wheatgrass, blue grama, and prairie junegrass. Total grass canopy coverage exceeds all other vegetative communities in the permit area. Common forbs include false tarragon sagewort, cudweed sagewort, broom snakeweed, Hoods phlox, and scarlet globemallow.

Ponderosa Pine/Grassland Unit

This vegetative community makes up less than 2 percent of the proposed disturbance area. Ponderosa pine (Pinus ponderosa) dominates the overstory; Rocky Mountain juniper (Juniperus scopulorum) occurs at a much lower density. Average age of the ponderosa pines is 58 years; the average height is about 26 feet. Pine density averages 28.3 trees per acre, juniper density averages 9.3 trees per acre. In the understory, bluebunch wheatgrass dominates, commonly growing with blue grama, prairie junegrass, needle-and-thread, and threadleaf sedge. Common forbs are broom snakeweed and Hoods phlox. Total shrub coverage is low; however, silver sagebrush, rubber rabbitbrush (Chrysothamnus nauseosus), prairie rose, skunkbush sumac, and snowberry all are present in varying amounts, skunkbush sumac being dominant.

Gumbo Knob Unit

The gumbo knob community covers less than 1 percent of the proposed disturbance area. Only two grass species were recorded during sampling: bluebunch wheatgrass and needle-and-thread. Total grass canopy coverage is less than all other communities described. Forb coverage is moderate, 90 percent of which is made up of eriogonum (Eriogonum multiceps) and broom snakeweed. Rubber rabbitbrush is the dominant shrub, although total shrub coverage is low (about 5 percent).

Creek Bottom Unit

This community is found only along the East Fork of Armells Creek at the northern boundary of the proposed permit area. It makes up about 6 acres (less than 1 percent) of the area proposed for disturbance. The overstory consists of box elder (Acer negundo), green ash (Fraxinus pennsylvanica), and a few plains cottonwoods (Populus deltoides). Understory grasses include Kentucky bluegrass (Poa pratensis) and western wheatgrass. Two shrubs, prairie rose and snowberry, commonly grow in the understory.

Disturbed Grassland Unit

This community, covering about 13 percent of the proposed disturbance area, was disturbed many years ago by plowing. It now consists primarily of crested wheatgrass (Agropyron cristatum), growing with some natives such as western wheatgrass and blue grama.

Corrals and Buildings Unit

These sites are small, making up less than 1 percent of the proposed disturbance area. They consist of farm and ranch yards, sheds, and corrals. Vegetation consists primarily of annual weedy species.

Sandstone Outcrops Unit

Sandstone outcrops cover less than 1 percent of the disturbance area, and consist of sandstone of the Tongue River member of the Fort Union formation.

Range Condition and Recommended Stocking Rates

The present range condition is considered "high-fair," indicating a productivity level of about 50 percent of climax vegetation. The recommended stocking rate (RSR) for the proposed disturbance area (not including the disturbed grassland unit) is 373 cow-calf units for a one-month grazing period, or 41 cow-calf units for a nine-month period. The potential RSR for this area is 612 cow-calf units for a one-month grazing period, or 68 cow-calf units for a nine-month period (assuming a production level of 75 percent of climax vegetation).

WILDLIFE

The information below comes from data presented in annual wildlife reports completed by Ecological Consulting Service and Western Energy Company since 1973. The data, from surveys initially covering a 200-square mile study area

(through 1977) and later a 160-square mile study area (starting in 1978), include the entire Rosebud Mine.

Habitat

The proposed permit area, extending southward to the edge of Greenleaf Ridge, overlays open, level lands adjacent to the East Fork of Armells Creek. Most of the area consists of flat terrain with slopes of 5 to 7 percent. The only sharp topography lies along the southern border of the area, where slopes reach approximately 50 percent. The steep topography makes up little of the permit area and even less of the proposed disturbance area.

The habitats available to wildlife on the proposed permit area roughly match vegetation types. A detailed description of types is presented in the vegetation section. The most prevalent type within the permit area is grassland, including upland grassland (about 65 percent) and disturbed grassland (13 percent). Grassland totals 78 percent of the proposed permit area and 83 percent of the proposed disturbance area. No other single type makes up more than 10 percent of either the proposed permit or the disturbance area.

Big sagebrush/grassland (8 and 7 percent) and silver sagebrush/grassland (6 and 5 percent) make up the second and third largest types. Together the ponderosa pine/grassland and skunkbush sumac/grassland types make up 6 percent of the permit area and 4 percent of the disturbance area. The northern area is therefore covered primarily with upland grassland type and the southern area with a diverse array of types.

Wildlife

Two commonly observed big game species within the proposed permit area are pronghorn antelope (Antilocapra americana) and mule deer (Odocoileus hemionus). Between 1973 and 1979, 60 pronghorn antelope and 40 mule deer sightings were recorded in sections 7, 8, 17, 18, plus a one-half mile "buffer zone," or band, around the area.

Aside from a population of ring-necked pheasants (Phasianus colchicus) receiving supplemental feed near the area A rail loop, the sharp-tailed grouse (Pediocetes phasianellus) is the major upland gamebird found in the area. During 1981 no upland gamebirds were identified within the proposed permit area (Western Energy Company, 1981). However, three dancing grounds lie within one mile of the permit area. Maximum movements from dancing grounds have been listed as 3 miles (Kobringer, 1965) and 2 miles (Western Energy Company, 1981). Hence, sharp-tailed grouse probably used the proposed permit area. The extent of use has not been determined. Table II-7 gives a breakdown of sharp-tail habitat use.

TABLE II-5

Percent of Sharp-Tailed Grouse Observations Made in Each Habitat Type by Season on the Western Energy Company Study Area During 1981

[Source: Western Energy Company, 1981]

Habitat Type	Winter (7)[a]	Spring (13)	Summer (2)	Autumn (6)	Totals (28)
Upland Grassland	0[b]	23	50	17	18
Big Sagebrush-Grassland	14	0	0	33	11
Silver Sagebrush-Grassland	0	38	0	17	21
Skunkbush sumac-Grassland	14	23	0	33	21
Gumbo Knob	0	0	0	0	0
Creek Bottom/Coulee Bottom	57	8	0	0	18
Timber-Grassland	14	0	50	0	7
Agricultural	0	8	0	0	4
Disturbed Areas	0	0	0	0	0
Reclamation	0	0	0	0	0

[a] number of observations
[b] percent of observations

The golden eagle (Aquila chrysaetos) is the most important raptor--owing to its status under the bald eagle protection act (16 USC 668a)--using the proposed permit area. An active nest was found approximately 1.5 miles south of the area in the Big Sky Mine study area (A. Fjell, Peabody Coal Co., personal commun., September 1, 1982). Two juveniles successfully left the nest. Golden Eagle hunting territories in Montana average about 42,000 acres (Jackman and Scott, 1975). A small portion of this territory is covered by the proposed permit area.

Inactive golden eagle nests have been found in sandstone outcrops to the west and in trees southeast of the proposed permit area. These nests may be alternate sites for the golden eagle pair.

No surveys of nongame birds were performed in the permit area. But surveys were conducted in habitats similar to the proposed permit area, indicating that nongame birds are also present in the permit area. Table II-8 lists the most common species and their densities on four habitat types within the Colstrip area. Methodologies for the transects can be found in Western Energy's Annual Wildlife Report (1981).

TABLE II-8
Songbird Breeding Densities (individuals per square mile) for Four Habitat Types on the Western Energy Company Study Area, 1981

[Source: Western Energy Company, 1981]

Species	Upland Grassland	Big Sagebrush Grassland	Timber Grassland	Reclamation
American kestrel		*	**	
Killdeer	16			
Mourning dove	**	**	**	**
Common flicker		*	16	
Red-headed woodpecker			16	
Eastern kingbird		16		
Western kingbird		8		
Black-capped chickadee			64	
White-breasted nuthatch			16	
Red-breasted nuthatch		*	24	
House wren			80	
Rock wren		*	16	
American robin			48	
Mountain bluebird		16	16	
Solitary vireo			48	
Yellow warbler		8		
Audubon's warbler			32	
Western meadowlark	112	24		96
Brewer's blackbird		16	*	
Brown-headed cowbird			*	
Pine siskin			16	
Red crossbill			*	
Rufous-sided towhee		*	48	
Lark bunting		*		
Vesper sparrow	32	16		32
Lark sparrow	8	48	16	
Chipping sparrow		16	80	
Clay-colored sparrow		8		
Brewer's sparrow		48		

* observed; not suspected of breeding
** suspected breeding

Small mammals have been sampled in the past within three native habitat types on the Rosebud Mine: an upland grassland site, a big sagebrush/grassland site, and a timbered/grassland site. The upland grassland site, similar to the majority of Area B, yielded three species of small mammals: prairie voles (Microtus orchrogaster), deer mice (Peromyscus maniculatus), and thirteen-lined ground squirrels (Citellus tridecemlineatus). The big sagebrush/ grassland site contained only the deer mouse and thirteen-lined ground squirrel. The timber/grassland site contained only the deer mouse.

A total of 465 coyotes (Canis latrans) were counted on the Rosebud Mine study areas from 1975-82 (average (X) = 58 per year). Coyotes used every grassland and grassland/shrub habitat type found on the proposed permit area. Two coyote observations (1978 and 1980) confirm the proposed permit area's used by coyotes. Red fox (Vulpes fulva), raccoon (Procyon lotor), and mink (Mustela vison) were occassionally observed on the Rosebud Mine study area.

CLIMATE

The semiarid climate at Colstrip is characterized by insufficient moisture to sustain dense vegetative growth (Critchfield, 1966). The climate is typical of the continental steppes of the northern Great Plains. Precipitation is low but variable and falls primarily during the warmer months. Diurnal and seasonal temperatures range widely. Surface humidity is low. Prevailing wind speeds are moderate.

Precipitation

Mean annual precipitation is 15.8 inches, over 70 percent of which falls from April through September. At least 0.01 inches of precipitation fall on each of at least 95 days in an average year. Recurrence intervals for 1-, 6-, and 24-hour precipitation events (e.g. rainstorms, snowfalls) are presented in table II-9. Snowfall averages about 35 inches per year.

TABLE II-9

Maximum Amount of Precipitation Expected at Colstrip During Various Time Intervals

[Source: Miller et al., 1973]

Length of event (hours)	Number of years considered					
	2	5	10	25	50	100
	Amount of Precipitation (Inches)					
1	0.7	0.9	1.2	1.3	1.5	1.7
6	1.0	1.3	1.6	2.0	2.2	2.4
24	1.4	2.0	2.4	3.0	3.4	3.8

Consumptive water use (total moisture loss from soil surface evaporation, plant growth, and transpiration) is calculated to be 22.8 inches (Toy and Munson, 1978). Since this exceeds annual precipitation by seven inches, moisture deficiency affects vegetation development and reclamation success.

Temperature

Average annual temperature in Colstrip is about 45° F. January is the coldest month with an average temperature of 21° F and an average minimum of 8° F. July is the warmest with an average temperature of 72° F and an average maximum of 90° F. The potential growing season, based on the frost-free period of 115 days, is effectively terminated during midsummer, when drought-induced dormancy of vegetation occurs (Toy and Munson, 1978).

Humidity

The average annual relative humidity was 55 percent in 1976 and 68 percent in 1977. The relative humidity is highest in winter and lowest in summer and varies widely, along with air temperature, between day and night.

Winds

Surface wind speed and direction are monitored by Western Energy from a meterological station on a 10-meter tower inside the Area A train loop. (See fig. I-6.) A "wind rose," figure II-7, summarizes the distribution of surface winds for 1980. Southerly winds predominated. Strongest wind speeds were from the west-southwest, slowest wind speeds from the east. Calm conditions occurred 15 percent of the time. Wind speeds in excess of 13 miles per hour occurred about 10 percent of the time, and wind speeds in excess of 25 miles per hour occurred less than one percent of the time.

The regional EIS on the Northern Powder River Basin (U.S. Department of Interior and Montana Department of State Lands, 1980) and the previous EIS on Area E (Montana Department of State Lands, 1981) contain detailed analyses of the climate at Colstrip. Climatic conditions have important effects on reclamation and revegetation success and on air quality impacts.

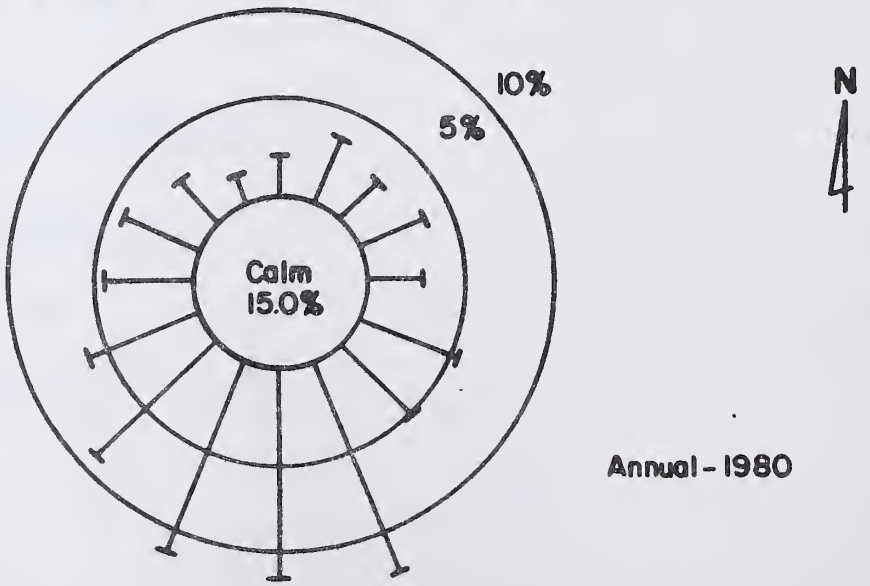


Figure II-7
Colstrip Area Annual Wind Distributions As a Percentage of Time

AIR QUALITY

Air quality in Colstrip meets neither Montana nor National Ambient Air Quality Standards (MAAQS and NAAQS, table II-10) because of high concentrations of total suspended particulate (TSP). As a result, the U.S. Environmental Protection Agency has designated a 120-square-mile zone surrounding Colstrip as a nonattainment area. Even so, data collected at 11 sites by Western Energy Company and at 4 sites by Montana Power Company (MPC) show that TSP concentrations are elevated only in an area of less than 10 square miles (on-file data, Montana Department of State Lands [MDSL]), including Colstrip and areas adjacent to the Rosebud Mine. The high concentrations are caused by mining, construction, power plant operation, motor vehicle traffic, and wind erosion of exposed areas (MDSL, 1981).

From 1976 through 1981 the annual average TSP concentration measured in Colstrip (MPC site No. 3) has ranged from 81 ug/m^3 (micrograms per cubic meter) to 130 ug/m^3. Outside this area, TSP concentrations have averaged about 25 ug/m^3, similar to areas of Montana considered to be pristine (U.S. Department of the Interior and MDSL, 1980). This situation, one of localized elevated TSP concentration, is characteristic of TSP emissions that contain large particles that settle out rapidly. The emissions therefore do not affect a large area (MDSL and USDI, 1982). Settled particulate amounts have also exceeded the MAAQS in the Colstrip area (table II-10). Visibility in the Colstrip vicinity is about 35 miles (MDSL and USDI, 1982).

Western Energy has undertaken a number of dust control measures in recent years (MDSL, 1980); however, the measures have not significantly reduced TSP concentrations in Colstrip. The company has an air quality permit (No. 1483) for Areas A, B, and E that is valid until the conclusion of mining. The Montana Department of Health and Environmental Sciences plans to bring Colstrip into compliance with the annual and 24-hour TSP standards by December 31, 1982. (See table II-10.) This intent is outlined in the State Implementation Plan submitted to the Environmental Protection Agency on April 23, 1979.

The air quality of the Colstrip area has been discussed in greater detail in recent EISs (MDSL and U.S. Office of Surface Mining, 1982; MDSL, 1981; MDSL, 1980; and USDI and MDSL, 1980). The reader interested in further information is directed to these documents.

EMPLOYMENT AND INCOME

Since 1970, energy development has fundamently changed Rosebud County's economy. The county has become the site of Western Energy's Rosebud Mine, Colstrip Generating Units 1 and 2, Peabody Coal's Big Sky Mine, and coal-related railroad employment in Forsyth. As a result, mining employment rose to 473 in 1980, more than 10 times the number in 1970. A smaller, but

Table II-10
Montana and National Air Quality Standards

Pollutant	Montana Standard	Federal Primary Standard	Federal Secondary Standard
Total Suspended Particulates	75 ug/m^3 annual arithmetic average	75 ug/m^3 annual geometric mean	60 ug/m^3 annual geometric mean
	200 ug/m^3 24-hr average*	260 ug/m^3 24-hr average*	150 ug/m^3 24-hr average*
Sulfur Dioxide	0.02 ppm annual average	0.03 ppm annual average	0.5 ppm 3-hr average*
	0.10 ppm 24-hr average*	0.14 ppm 24-hr average*	
	0.50 ppm 1-hr average**		
Carbon Monoxide	9 ppm 8-hr average*	9 ppm 8-hr average*	9 ppm 8-hr average*
	23 ppm hourly average*	35 ppm 1-hr average*	35 ppm 1-hr average*
Nitrogen Dioxide	0.05 ppm annual average	0.05 ppm annual average	0.05 ppm annual average
	0.30 ppm 1-hr average		
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hr average*	0.12 ppm 1-hr average*
Lead	1.5 ug/m^3 90-day average	1.5 ug/m^3 calendar quarter average	None
Foliar Fluoride	35 ug/g grazing season	None	None
	50 ug/g monthly average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particlate scattering coefficient of of 3 x 10^{-5} per meter annual average***	None	None

* Not to be exceeded more than once per year
ug/m^3--micrograms pollutant per cubic meter of sampled air
ppm--parts pollutant per million parts of sampled air
** Not to be exceeded more than 18 times per year
*** Applies to PSD (Prevention of Significant Deterioration) Class I areas

substantial, increase occurred in the transportation and utility industries, where employment increased nearly threefold over the decade to 480 in 1980. The construction of Colstrip Units 3 and 4 began in earnest in 1980 and will continue the transition of the county from an agrarian economy to an economy primarily dependent on energy development.

Of the 473 jobs in mining, about 320 were at the Rosebud Mine, including about 200 at Area B. Since production began in 1976, employment at Area B has fluctuated in relation to changes in the coal production level.

The past decade's energy development spurred the remainder of Rosebud County's economy. Led by increases in the service industry, combined employment in the service, trade, finance, and real estate sectors nearly tripled between 1970 and 1980, growing from 596 to 1,602 jobs. Government employment grew 53 percent during the 1970s, from 489 jobs in 1970 to 750 jobs in 1980.

Over the same period, agricultural employment declined, as it has for more than four decades. Even so, agriculture continues to be an important part of the county's economy. The 604 agricultural jobs in 1980 represented more than 16 percent of the county's economic base employment. Only services and government provided more jobs.

As the employment pattern has changed in Rosebud County, so has the composition of total personal income. Labor and proprietor's income was the largest component of personal income in 1970 and has since grown faster than--increasing its relative position to--other elements. Led by increases in wages and salaries in the construction, mining, transportation and utilities industries, labor and proprietor's income rose more than fivefold between 1970 and 1980, growing from $13.2 million to $70.6 million. Likewise, since personal income grew faster than population, per capita income also grew, rising in constant 1967 dollars from $2,380 in 1970 to $3,213 in 1980. Per capita income in Rosebud County varied much more than in Montana as a whole during the 1970s, reflecting the wages paid during the construction of Colstrip Units 1 and 2 and the cyclical nature of agriculture income.

SOCIAL CONDITIONS

Population

Rosebud County

Rosebud County's 1980 population was 11,278 persons (Mountain West Research, Inc. [MWRI], 1981) a density of about two people per square mile. The county's population nearly doubled from 1970 to 1980 and has since increased to an estimated 16,052 in 1982 (MWRI, 1981). In the past ten years the population has shifted to contain a higher proportion of younger males. The average household size in 1980 was 2.61 persons, 0.21 persons higher than the state average.

Colstrip

Colstrip's 1980 population was 3,750 (MWRI, 1981), about seventeen times the population in 1970. The 1982 population was estimated to have increased to approximately 7,844 (MWRI, 1981). The shift in the county's population toward a composition of younger males is especially pronounced in Colstrip.

Forsyth

In 1980 there were 3,054 people living in the Forsyth area (including Enumeration District 1538 outside the city limits). This number is a 163 percent increase over the 1970 population of 1,873 people, although the 1970 figure only includes people living within the city limits. The estimated 1982 population for the Forsyth area is 3,500 (MWRI, 1981).

Housing

Rosebud County

The total number of housing units in Rosebud County increased from 2,055 in 1970 to 4,363 in 1980, or 112 percent. Mobile homes accounted for almost 60 percent of all new housing units in Rosebud County between 1970 and 1980 (U.S. Bureau of the Census, 1981). About 42 percent of the county's housing-unit increase occurred in Colstrip (MWRI, 1981). Mobile homes compose 36 percent of the county's housing stock, whereas they compose only 12 percent of the State housing stock.

Colstrip

Between 1970 and 1980 Sunlight Development Company, a Montana Power Company subsidiary, financed or constructed 960 housing units in Colstrip, including single-family dwellings, multi-unit apartments, mobile home spaces, recreational vehicle pads, and temporary housing. These units have been built to house the construction work force required for the Colstrip generating units and Western Energy mining operations (Colstrip High School Bond Prospectus, 1981).

In January, 1982, the Sunlight Development Company reported that 1,403 permanent housing units and 906 temporary units were available, and 405 more units were under construction. In addition, 124 additional single-family units were proposed, and 224 additional lots were available for development (Pat Reardon, Sunlight Development Company, personal commun., January 4, January 7, and February 9, 1982).

Costs of housing are higher in Colstrip than Forsyth. Homes that cost $80,000 to $85,000 in Colstrip are priced at $50,000 to $60,000 in Forsyth. Apartment rentals in Colstrip are $155 per month for a one-bedroom, $205 to

$350 per month for a two-bedroom, and $255 to $450 per month for a three-bedroom unit. Houses rent for over $500 per month. Installed mobile homes rent for $280 to $370 per month (MWRI, 1981; Pat Reardon, personal commun., January 4, January 7,and February 9, 1982). There are few vacancies in Colstrip today.

Current plans are to convert the Big Timber, Sweet Grass, and Stillwater mobile home pads to single-family lots when the construction phase for Colstrip Units 3 and 4 ends. This would make available 550 more lots, in addition to the 224 potential lots now available (Pat Reardon, personal commun. January 4, January 7, and February 9, 1982).

Forsyth

The 1980 census count identified 1,258 housing units in Forsyth, of which 1,242 were year-round. The housing mix consisted of 62 percent single-family detached units, 15 percent multi-family units, and 23 percent mobile homes. The census count identified 89 percent of the units as being occupied.

Social Life

A brief social history and description of social life of the Colstrip area is given in the final EIS on Rosebud Mine's Area C, Block I (Montana Department of State Lands, 1982). A summary of the Area C EIS's findings follows. Only social life at Colstrip is examined here, since Colstrip is the most sensitive to changes at the Rosebud Mine.

Colstrip has had periodic temporary growth associated with the railroad and mining. But not until the early 1970s did the population grow rapidly. This growth raised conflicts over land use, economics, politics, and values (Gold, 1974, 1975). Contributing to these conflicts has been Montana Power's ownership of the entire community and the high percentage of temporary jobs. In addition, the arrangement within Colstrip of permanent and temporary housing and status differences in the town limit social contact between different groups, although the limitations appear to be decreasing.

There does not appear to be a distinctive Colstrip life style, but life in Colstrip is different from the remainder of Rosebud County. The residents' feelings of isolation, their higher salaries, and the lack of shopping and recreation in Colstrip encourage residents to travel to nearby cities more often than other Rosebud County residents. The transient part of the population, having family ties outside Colstrip, adds to the tendency to frequently travel.

Value differences exist between old and new residents and between permanent and temporary residents. The differences reportedly concern materialism, stability, and education. Organized religion appears to have only average or less influence on the community. Transient residents are less active than permanent residents in churches.

Much of the conflict that arose at the time of Colstrip's rapid development in the 1970s no longer exists. The emphasis has moved from groups resisting or supporting any development to individuals debating how to develop. Colstrip residents are reportedly apolitical and have little impact on county politics.

Family life is reported as important in Colstrip, especially to permanent residents. The divorce rate for all of Rosebud County has actually been lower than the rate for Montana as a whole. Yet two of the three most frequently mentioned social problems are divorce and family instability. The importance attached to family life may lead to greater concern over family related social problems.

Another frequently mentioned social problem is alcohol and drug abuse. Rosebud County's institutional admission rate for alcohol treatment is nearly three times higher than the State rate. The Colstrip rate, however, cannot be easily distinguished from that of the entire county.

SOCIAL AND COMMUNITY SERVICES

Law Enforcement

The Rosebud County Sheriff provides law enforcement in Colstrip. The sheriff's jurisdiction includes all of Colstrip. Six deputies, five dispatchers, and one dogcatcher are assigned to the Colstrip office. An additional deputy patrols the rural area between Colstrip and Ashland.

Law enforcement personnel and equipment are located in the Colstrip Community Service Center. Detention facilities comprise four cells, each with two bunks. The Colstrip Sheriff's office is provided with three patrol cars and one pickup truck. Communications are provided by a low-frequency band radio system. The sheriff's office provides communications and dispatching service for the local emergency medical service and fire protection organizations. The sheriff considers his manpower and equipment adequate to serve the present population (Robert Ash, Rosebud County Sheriff, personal commun., January 6, 1982).

Fire Protection

A 22-member volunteer fire department provides fire protection services in Colstrip. At present, only the chief is certified, but all volunteers are expected to be certified by 1983. Water flows to hydrants in Colstrip are considered adequate now and for the foreseeable future. The fire department is equipped with two pumpers and one tanker. An additional 1,000-gallon pumper should be delivered by the fall of 1982.

Equipment storage is provided at the Colstrip Community Services Center and is considered adequate. A two-stall garage, where the new fire truck will be stationed, is to be constructed near the Pine Butte School in the northern end of Colstrip in the fall of 1982. The Colstrip fire chief considers his department adequate to meet the fire protection needs of Colstrip for the present and the foreseeable future (Ray Durham, Chief, Colstrip Fire Department, personal commun., February 3, 1982).

Sanitary Sewer

Wastewater in Colstrip is treated with an oxidation ditch facility that is supplemented by an aerated lagoon, installed at the site of an older, now unused, three-cell lagoon system. The town's wastewater is retained in the aerated lagoon for a ten-day treatment period, after which it is discharged to the oxidation ditch. The remaining two cells of the old lagoon system are used as sludge drying beds (Mountain West Research, Inc., [MWRI], 1981; Pat Reardon, personal commun., August 24, 1982).

Water Supply

The Colstrip public water supply is drawn from Castle Rock Lake, a pond built to supply water to the Colstrip generating units. The water treatment and distribution systems has a capacity of 5,000 gallons per minute (gpm), and a storage capacity of 3,350,000 gallons (MWRI, 1981; Pat Reardon, personal commun., August 24, 1982).

Solid Waste

Solid waste collection and disposal services are now provided by a rural refuse disposal district. The district is served by a three-man crew equipped with one truck with a 25-cubic-yard compactor. Solid wastes are buried in old strip-mine cuts sealed with clay. Old mine spoils are graded over the solid wastes. The present dump site serves Rosebud and Treasure Counties. The Northern Cheyenne Reservation reportedly also will use that disposal site in the near future. Solid waste collection capacity is adequate at present, with one collection day per week.

Social Welfare

In the quarter ending in March, 1982, 121 cases were served and 60 cases closed by the Rosebud County Department of Public Welfare. Of the 389 total services provided, the highest service incidence was in protective service investigation (118 cases), with 49 cases involving on-going protection. According to caseload reports from Montana Department of Social and Rehabilitation Services (Donna Wirth, Montana Department of Social and Rehabiliation Services, personal commun., July, 1982), Rosebud county workers have caseloads that exceed State standards. A grant from the Montana Coal Board to the Rosebud County Department of Public Welfare for fiscal year 1983 is intended to provide an increase in both professional and support personnel.

Medical Services

The outpatient medical needs of Colstrip are served by the Colstrip Medical Clinic, a Southeastern Montana Rural Health Initiative (SEMRHI) clinic funded by a grant by the U.S. Department of Health and Human Services. All of the counties that are served by SEMRHI are considered medically underserved. The clinic's professional staff includes two general practitioners, two part-time registered nurses, and one x-ray technician (M.S. Catapano, Physician, Colstrip Medical Clinic, personal commun., January 6, 1982). The clinic has three examining rooms, an x-ray unit, a laboratory, and a fully equipped emergency room (Sue Palm, Colstrip Medical Clinic, Colstrip Montana, personal commun., Jan. 26, 1982). The medical staff and facilities are adequate to serve the Colstrip community (Jeannette Viall, SEMRHI Program, Miles City, Montana, personal commun., February 4, 1982).

The Colstrip Dental Clinic and optometrist are located in the same building (Colstrip Mall) as the Medical Clinic. There are two dentists, two dental assistants, and one dental hygienist (Barbara May, Colstrip Dental Clinic, personal commun., January 26, 1982). The optometric office staffs one part-time optometrist (two days a week) and an optometric assistant (Margaret Porter, Colstrip Optometric Clinic, personal commun., January 26, 1982).

The Eastern Montana Community Mental Health Center of Miles City administers mental health services for Colstrip. The Colstrip Mental Health Center, staffed by one psychologist, handled approximately 50 cases in 1981 (MWRI, 1981). The Mental Health Center is now at maximum capacity (Jim Peterson, Eastern Montana Community Health Center, Miles City, Montana, personal commun., February 3, 1982).

There are four ambulances in Colstrip, two owned by Bechtel Energy Company and two by the Colstrip Emergency Medical Service. Helicopter and fixed-wing air ambulance service is available through Saint Vincent Hospital in Billings. The Emergency Medical Service is staffed by 11 volunteers (Joe Kampf, Colstrip Emergency Medical Service, personal commun., January 26, 1982). This emergency service is adequate for current needs (MWRI, 1981).

Rosebud Community Hospital, 33 miles north in Forsyth, is the closest hospital to Colstrip. It has a staff of 36 persons. The hospital has 18 licensed beds, maternity care, emergency facilities, an x-ray department, and a part-time pharmacy (Montana Department of Health and Environmental Sciences, 1980). During 1980, the hospital had a 21 percent occupancy rate (patient days/licensed beds X 365 days X 100%).

Forsyth is also the closest city offering nursing home facilities to Colstrip residents. The Rosebud Community Nursing Home has 39 skilled-care beds and eight intermediate-care beds. The home had an 83 percent occupancy rate in 1980 (patient days/(skilled beds + intermediate beds)/days reporting x 100%) (Montana Department of Health and Environmental Sciences, 1980).

Education

Colstrip School District No. 19 currently operates two elementary schools. In mid-January, 1982, the Isabelle Bills Elementary School's enrollment was 370 students. Class size ranged from 17 to 28 pupils and averaged 20.6 pupils. The Pine Butte Elementary School, now supplemented with another building, had an enrollment of 340 students. Class size ranged from 14 to 21 students and averaged 17 (Harold Tokerud, Superintendent, Colstrip District No. 19 Schools, personal commun., January 16, 1982).

Both elementary schools have large physical plants and space for many more students. Using the minimum accreditation standard as a guide, the existing elementary school classroom configuration could accommodate up to 321 more students. In mid-January, 1982, the Colstrip elementary school district was being operated at approximately 69 percent of capacity (Mrs. Paul Hofeldt, Colstrip District No. 19 School Board, personal commun., January 4, 1982).

Colstrip Junior High School is located in a modular, wood-frame structure that will need to be replaced in the near future. The seventh- and eighth-grade enrollment is 158 children and the average class size is 21.1 students, well below the accreditation maximum class size of 30 students (Mrs. Paul Tokerud, personal commun., January 4, 1982).

Colstrip High School is a masonry structure with a wood-frame addition. A proposed new high school, to be completed in fall 1983, will accommodate 500 students. The current high school structure will be converted to a middle school for grades six through eight (Elsie Schye, Clerk, Colstrip School District No. 19, personal commun., February 12, 1982). In mid-January, 1982, the Colstrip High School enrollment was 323 students. Class size ranged from one to 23 pupils and averaged 9.1 students (excluding study hall). The largest individual teaching load for an instructor was 77 students.

FISCAL CONDITIONS

Property taxes are the most important source of local government and school district revenues in Rosebud County. The taxable value associated with the gross proceeds (45 percent of the contract sales price of the coal) of the Western Energy and Peabody mines and the Colstrip generating units has become the major source of property taxes. State and Federal impact assistance have also provided significant amounts of revenue to local governments and school districts in the county.

Property taxes have provided an average of 40 percent of Rosebud County's revenue over the last four years. General fund revenues in the Colstrip school district are provided by property taxes paid in that district. In school districts that do not directly benefit from coal development, such as the elementary and high school district in Forsyth, most general fund revenues come from the County Equalization Levy.

In 1980 the gross proceeds of the two coal mines in the county provided about 28 percent of the county's taxable value; the power plant and mining machinery provided about 39 percent; oil production provided 14 percent; agriculture 7 percent; and the balance came from other types of property (Montana Department of Revenue, 1980). Area B has provided as much as 57.6 percent of the mine's taxable value since production began in 1976. (See table II-11.)

From 1968 through 1981, Western Energy paid $134.5 million in taxes, not counting income and payroll taxes. (See table II-12.) Area B taxes were $35 million during the same period.

Not all jurisdictions in Rosebud County have benefited equally from the increases in taxable value brought about by energy development. Between fiscal year (FY) '71 and FY '81, taxable value in Rosebud County grew by 725 percent; in the town of Forsyth the increase was only 45 percent. Real per capita taxable value (taxable value corrected for inflation divided by population) in Rosebud County (in 1967 dollars) went from $1,742 in FY '71 to $4,038 in FY '81. During the same period, Forsyth's real per capita taxable value decreased from $631 to $310.

The changes and consequent disparity in the tax base were reflected in the mill levy or tax rate. The Rosebud County mill levy decreased by 67 percent between FY '71 and FY '81. The Forsyth town and school districts levy increased by 25 percent in the same period. The decrease in the county levy was more than overcome by increases in Forsyth.

School districts were similarly affected. Property taxes in the Colstrip school districts were relatively low in FY '71, totalling 82 mills compared to 86 mills in Forsyth and 112 mills in similar-sized school districts elsewhere in the state. In FY '81 the Colstrip school levy was 73 mills, compared to 138 mills both in Forsyth and elsewhere.

LAND USE

Native rangeland makes up 1,598 acres of the 1,820-acre Area B extension. There are 7 acres of corrals and ranch yard and the remaining 229 acres are "disturbed rangelands" (areas farmed in the past and reseeded to introduced grasses). The disturbed rangeland areas are now used for cattle grazing.

The recommended stocking rate for the proposed disturbance area is 373 AUMs (cow-calf units for a one-month grazing period). The area is in a "high-fair" range condition. (See chapter II, Vegetation.)

TABLE II-11
Western Energy Company Taxable Value Summary
1968-1981

[Source: Western Energy Company, written commun., July 19, 1982]

Year	Total Mine Taxable Value			Area B Taxable Value		
	Net Proceeds	Gross Proceeds	Physical Plant	Net Proceeds	Gross Proceeds	Physical Plant
1968	-0-	-0-	$ 229,815	-0-	-0-	-0-
1969	-0-	-0-	236,245	-0-	-0-	-0-
1970	$ 427,412	-0-	661,794	-0-	-0-	-0-
1971	1,184,699	-0-	1,487,329	-0-	-0-	-0-
1972	3,666,440	-0-	4,122,826	-0-	-0-	-0-
1973	3,253,873	-0-	3,797,528	-0-	-0-	-0-
1974	1,622,043	-0-	2,567,318	-0-	-0-	-0-
1975	-0-	-0-	3,656,987	-0-	-0-	-0-
1976	-0-	$ 9,588,971	14,417,294	-0-	$ 1,194,736	$ 1,170,684
1977	-0-	14,713,501	20,259,542	-0-	5,538,923	7,882,988
1978	-0-	14,235,217	18,978,295	-0-	3,483,859	3,858,287
1979	-0-	17,136,544	21,859,551	-0-	3,321,449	3,233,028
1980	-0-	22,457,399	28,536,790	-0-	2,676,122	3,227,511
1981	-0-	23,661,554	29,824,896	-0-	13,621,957	17,170,193

TABLE II-12
Western Energy Company Tax Summary
1968-1981
[Source: Western Energy Company, written commun., July 19, 1982]

Year*	Net Proceeds Property Tax	Gross Proceeds Property Tax	Physical Plant Property Tax	Severance Tax	Resource Indemnity Trust Tax	Federal Abandoned Mines Reclamation	Federal Black Lung Excise Tax
1968	-0-	-0-	$ 32,354	$ 1,945	-0-	-0-	-0-
1969	-0-	-0-	33,042	20,788	-0-	-0-	-0-
1970	$ 58,853	-0-	32,317	21,319	-0-	-0-	-0-
1971	147,473	-0-	37,787	249,586	-0-	-0-	-0-
1972	418,770	-0-	52,180	429,011	-0-	-0-	-0-
1973	438,104	-0-	73,725	610,847	-0-	-0-	-0-
1974	209,752	-0-	122,937	1,107,832	$ 36,434	-0-	-0-
1975	29,766	-0-	366,203	2,854,200	42,124	-0-	-0-
1976	-0-	$ 919,554	463,508	9,091,881	99,415	-0-	-0-
1977	-0-	1,192,338	452,938	9,937,542	113,967	-0-	-0-
1978	-0-	1,331,591	446,784	10,673,472	103,674	$ 3,571,036	$ 793,751
1979	-0-	1,687,710	4,723,007	13,756,352	127,889	3,912,979	1,433,333
1980	-0-	2,123,617	6,079,391	15,566,965	185,561	3,794,642	1,467,137
1981	-0-	2,762,486	6,163,342	18,507,106	196,076	3,625,684	1,786,990
Total	$1,302,718	$10,017,296	$19,079,515	$82,828,845	$905,140	$14,904,341	$5,481,211
			Area B Proportion				
1976	-0-	$ 74,668	$ 37,637	$ 738,523	$ 8,075	-0-	-0-
1977	-0-	463,939	176,238	3,867,466	44,353	-0-	-0-
1978	-0-	270,712	90,831	2,169,725	21,075	$ 725,927	$ 161,335
1979	-0-	249,612	698,533	2,033,992	18,909	578,567	211,930
1980	-0-	240,181	687,579	1,761,390	20,996	429,361	166,005
1981	-0-	1,590,363	3,548,236	10,654,214	112,877	2,087,242	1,028,739
Total	-0-	$2,889,475	$5,239,054	$21,225,310	$226,285	$3,821,097	$1,568,029

*Calendar year the tax was paid

TRANSPORTATION

Rosebud County's transportation network is made up of secondary, primary, and interstate highways, a railroad, and a county-owned and operated airport east of Forsyth. (See fig. II-8.) Federal Aid Primary (FAP) 39 connects Colstrip to Interstate 94 to the north and to FAP 37 (US 212) to the south.

Coal mined from Area B is shipped on the Burlington Northern Railroad spur to the main line north of Colstrip and then east to final destinations. (See Chapter I.) The railroad spur now crosses FAP 39 four times. A grade separation (highway overpass) has been built in Colstrip, carrying the highway over the rail access to Areas A and B. (See fig. II-8.) No grade separation is planned for the railroad crossing south of Colstrip (the access to the Big Sky Mine), but the final portion of major reconstruction of FAP 37 between Colstrip and I-94 does include grade separations for the two railroad crossings north of Colstrip. Reconstruction of FAP 37 is expected to be completed in the spring of 1983.

An average of three (a maximum of 7) loaded trains per day leave Colstrip. Most trains are loaded from the Areas A and B loadout facility; some are loaded from the Area E facility.

RECREATION

Outdoor recreation facilities in Colstrip include a 51-acre park system, a swimming pool, a wading pool, three tennis courts, three basketball courts, and five playgrounds for young children. Colstrip is in the process of building a new outdoor recreation complex, to be named Stillwater Park, which will comprise one baseball and two softball fields, a soccer field, an outdoor basketball court, and a playground area. Indoor facilities are provided at the Colstrip Community Center, which comprises 16,000 square feet of space that include two handball/racquetball courts, a weight/exercise room, a basketball court, and a meeting room.

Public recreation areas outside the town of Colstrip are limited. Facilities include a motocross course and rodeo grounds, the Rosebud State Park near Forsyth (picnic sites, fishing, boating); Castle Rock Lake (the 152-acre Montana Power water supply pond), 95,827 acres of Custer National Forest lands, and 230,000 acres of public land managed by the Bureau of Land Management. In addition, the Yellowstone and Tongue Rivers, as well as the Tongue River Reservoir in Big Horn County, provide boating, fishing, and bird watching.

The major recreation values of the public lands in the county are isolation, diverse topography, scenery, and big game. Hunting is the primary use. Other popular activities include picnicking and fishing. Outdoor recreation

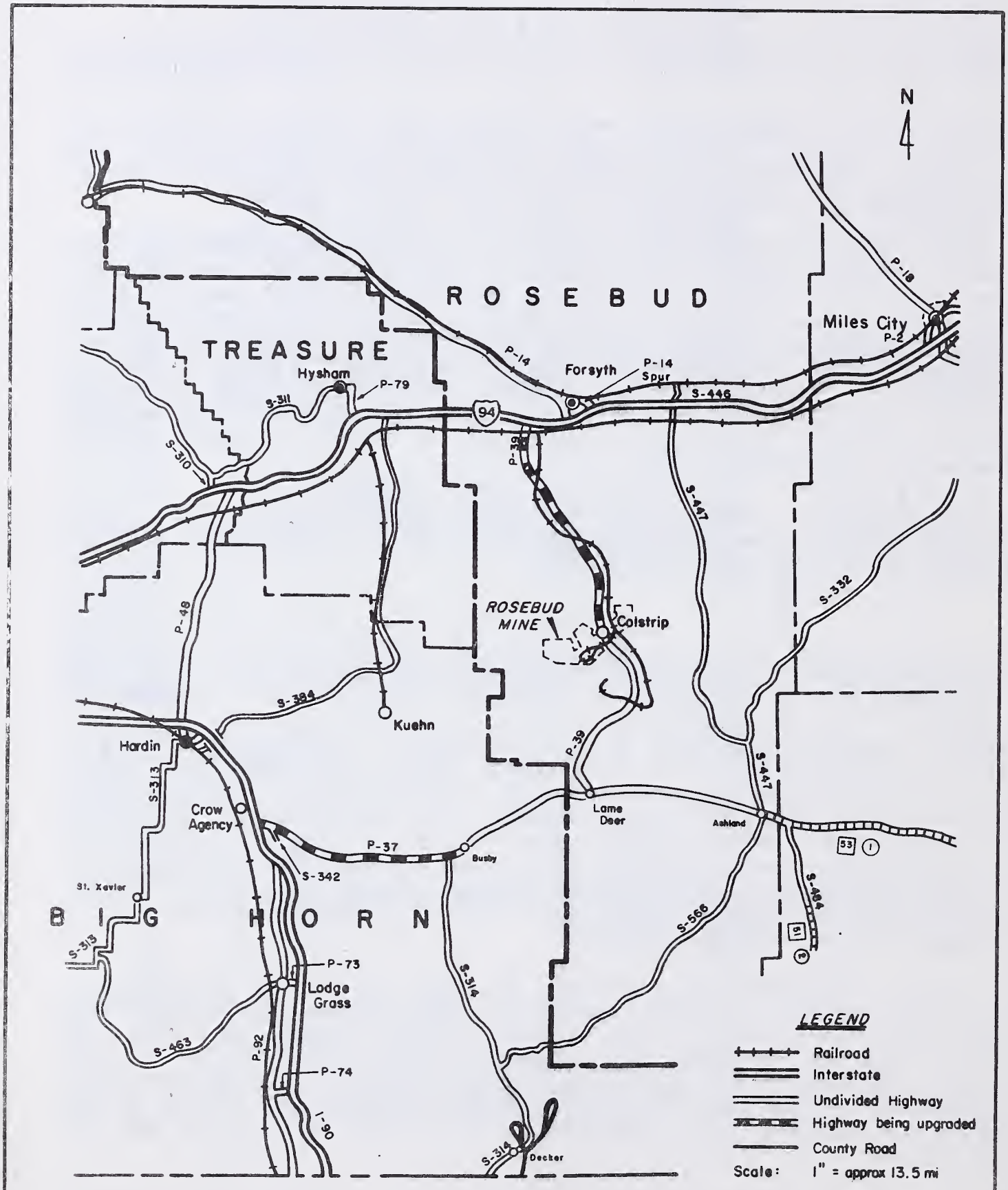


FIGURE II-8--Transportation Routes Near Colstrip

use of the lands and facilities outside Colstrip is not now approaching capacity (Montana Department of State Lands, 1981).

CULTURAL RESOURCES

The Area B extension area and a one-mile buffer zone were surveyed for cultural resources in 1979 and 1980. The data from these studies are included in Western Energy's Area B mine plan.

Within the study area (bonded permit area) only two prehistoric site were found. These sites, How Dry I Am (24RB252) and Rock Shelter (24RB1031), do not appear to meet the criteria for nomination to the National Register of Historic Places (NRHP). Other cultural resources found within the permit area were 22 indistinct sites/isolated finds.

In the buffer zone, 4 homesteads and 22 prominent sites, none containing rock art or rock shelters, were identified. Two of the prominent sites, Old Homestead Kill and Sly Bison, have either been excavated or are in the process of being excavated. Three buffer zone sites, the Doc Taylor Place (24RB1065), the Muskrat Homestead (24RB313), and the Sly Bison (24RB267), have been officially determined as eligible for nomination to the National Register. The West Homestead (24RB95) was determined in 1980 to be ineligible for the National Register. Since that 1980 determination, the Montana State Historic Preservation Office has further evaluated the site and found that the site may now be eligible. The Picture Window Homestead (24RB392) and the remaining prominent sites do not appear to be eligible for nomination to the Register.

AESTHETICS

The proposed mine area is located on flat and gently rolling rangeland. To the south of the area rise ponderosa pine-covered bluffs that appear on the horizon as a long flat ridge. On the flanks of the bluffs are occasional sandstone and clinker outcrops. The lowest bluffs reach 50 feet above the rangeland; the highest stand about 100 feet above the area.

Dominant in the landscape is the ponderosa pine forest on the horizon. The dark green ponderosa pines contrast with both the sky and the light green grassland of the lowlands. The landscape, as seen from nearby roads, provides a far-reaching vista, bounded in the distance by the ponderosa pine bluffs.

The view over the proposed disturbance area offers little variety, except for an occasional break in the wooded ridgeline and shallow coulees (drainages) that descend into the mine area. The only manmade changes in the landscape are fencelines, scattered power poles, and outbuildings, all typical of agricultural land in this part of the West.

The landscape is pleasant, but not unusual or distinctive. Much of the terrain in the area around Colstrip and in this part of the State offers vistas with similar features. Many nearby views offer more variety and appear more distinctive.

The area can be seen from a two-mile segment of highway FAP 39 and from about five miles of the county road along the East Fork of Armells Creek. The area is thus visible to residents of Colstrip and to travelers of the gravel road along the creek. Only one residence is located close to the area. The area is not used for recreation, since all Western Energy lands are closed to public use.

Western Energy is now mining adjacent to the proposed extension area. As a result, the extension area is not pristine. Rather, it is an undisturbed site lying at the perimeter of an industrial setting. Nearby, spoils piles and working draglines are visible. In the distance rise the stacks of Colstrip Units 3 and 4.

Chapter III

IMPACTS OF THE EXTENSION OF AREA B

This chapter covers 18 topics, presenting subject by subject the impacts--mostly unavoidable--that could be caused by the extension of Area B into sections 7, 8, 17, 18, 12 and 13. At the start of each topic is a summary of the major impacts anticipated to be caused by the mine extension. Following the summary is a detailed discussion of the impacts. Each section ends, when appropriate, with a list of "mitigating measures," or actions that could be taken to reduce or eliminate the extension's projected impacts.

The reader is reminded that, although the discussion contained in this addendum is complete, the coverage of impacts is not always in detail. For additional information, refer to the Rosebud Mine Comprehensive Study.

GEOLOGY

Summary of Impacts: The impacts on the geologic setting of Area B would not be significant. The revegetated landscape of Area B would be as stable as the premining landscape. A few gullies may develop in the uplands along the southern boundary of Area B on land used for highwall reduction. Small draws could develop along drainages due to headward channel development. Development of gullies and draws would not adversely effect postmining land uses.

Overburden physiochemical characteristics are not expected to adversely affect postmining revegetation success.

Topography and Geomorphology

The topography and stability of the postmining landscape of the Area B extension area would be gentler but similar to the present, unmined landscape. The postmining drainage network Western Energy proposes to construct would closely approximate the premining network. All large, reconstructed, ephemeral drainages would have slopes and positions similar to those of existing drainages.

Several small (less than 800 feet long) draws would not be replaced, which may mean that small draws would develop naturally over time. Washing of sediment downstream during the development of these draws would not likely cause problems. Such downcutting would be initiated during high runoff, when large amounts of sediment would be emptied into surface waters from the entire basin, masking any increases from Area B.

To blend the unmined topography with the regraded topography of Area B, Western Energy would grade undisturbed areas into the final mine pit--the process called highwall reduction. As a result of this regrading, the highwall reduction areas along the southern edge of Area B would be less steep than premining slopes.

During the first few years after reclamation, the postmining landscape would be susceptible to heavy erosion during strong thunderstorms or rapid snowmelt. In particular, it may be difficult to keep the highwall reduction area from developing gullies during initial revegetation efforts. The removal of bedrock during mining may enhance the development of gullies, since bedrock restricts the downcutting action of runoff water.

Highwall reduction areas have undergone gully and piping erosion elsewhere in the Rosebud Mine (Montana Department of State Lands [MDSL] and U.S.D.I., Office of Surface Mining [OSM], 1982 p. III-1). Localized subsidence and differential settlement have in part been responsible. Subsidence may occur in the Area B extension area, especially in the deeper overburden areas along the southern portion of Area B, possibly causing gullies and piping features. Subsidence usually stops within 3 years after initial reclamation (MDSL and OSM, 1982, p. III-4).

Gullies and piping features deeper than 9 inches must be filled in and revegetated by the company for the period the company is subject to bonding requirements. After bond release, (probably 10 to 20 years after initial vegetation) a few gullies and small draws might develop due to headwater channel development, caused during high runoff. These gullies would not seriously affect postmining land uses, since existing gullies have not done so. Small gullies are a part of the existing, steeper landscape areas and tend to form naturally.

To retain runoff and sediment eroded from disturbed areas prior to bond release, Western Energy would build ten sedimentation ponds in the reclaimed drainage network. The ponds would allow sediment to settle out. Sediment ponds have been very effective in preventing degraded surface water from flowing out of mine areas. As a result of the ponds, the actual amount of sediment reaching the East Fork of Armells Creek would be less than before mining. By impounding peak runoff water and sediment, the sedimentation ponds may temporarily change the channel characteristics of the East Fork of Armells Creek. (See Hydrology, Surface Water.)

Western Energy will conduct a subsidence monitoring survey in Area B sections 7, 8, 17, and 18. The program will be similar to the one now used in Area A. The monitoring data, showing accurate elevation readings across the reclaimed areas over time, will be submitted to the Department of State Lands

each year. The Department will review the data and determine on a case by case basis what, if anything, needs to be done regarding subsidence.

Stratigraphy

The Rosebud coal seam would be removed by mining and the Rosebud overburden (spoil) placed back into the mined-out pit. The overburden strata have no unique or intrinsic value.

Overburden

The effects of overburden (spoil) on postmining ground water quality are discussed in Hydrology.

Overburden physiochemical characteristics are not expected to adversely affect postmining revegetation. (See table II-1.) Average zinc values are high, but this is attributed to contamination by the zinc-based lubricant used in drilling. This is demonstrated in a number of individual drill cores, where zinc values were high only at 20-foot intervals, the length of drilling stems. These abnormally high values raised some of the overall averages for zinc shown in table II-1. Western Energy has recently redrilled two overburden holes and analyzed each 5-foot increment for zinc. The results show that no zinc concentrations are greater than 4 ppm, which indicates that drill-stem lubricant contamination was indeed the cause of the abnormally high zinc values discussed in the draft EIS.

In cases where drilling lubricant contamination is extremely high--hundreds of parts per million--the contamination may hamper the ability of the chemical extractant used in lab analysis (DTPA) to extract other trace elements (Dollhopf et al., 1981). Zinc concentrations of this magnitude are reported for a few five-foot increments in the permit area and may have lowered reported concentrations of other elements in the same increment analyzed; however, the number of increments with extremely high zinc concentration is small, and no problems are anticipated.

Nickel values in some cores exceeded the current state suspect level of 1.0 part per million (ppm); however, Montana state suspect levels are now being revised to reflect recent research. According to an extensive literature review prepared by Barth et al. (1981), nickel is regarded as relatively nontoxic to animals. That is, most mammals appear to have some way of limiting the absorption of nickel. One thousand ppm nickel in forage has been found to have no toxic effect on grazing animals. Nickel toxicity to plants is most commonly observed in contaminated soils near smelters. Twenty or more ppm nickel in the soil can cause toxicity in the more intolerant plant species. The potential for nickel toxicity appears to be greatest on poorly drained acid soils, conditions that are not found at the Rosebud Mine.

Prior to operation of Colstrip Generating Units 1 and 2, Munshower et al. (1978) studied soils, vegetation, and animals in the Colstrip vicinity for production and element concentrations. The report shows that prior to the

start-up of the generating units the soils in the area had available nickel concentrations approaching 1 ppm. The native range vegetation and introduced species tested had nickel concentrations ranging between 1 to 4 ppm dry-weight. In light of this data, addition of 1 to 2 ppm nickel to the plant growth medium at Colstrip would probably not adversely affect revegetation success. This is especially true since alkaline soils, like those in the permit area, greatly decrease the actual amount of nickel available for plant uptake.

Structure and Geologic Hazards

Based on the lack of geologic failures (faults or landslides) in the recorded past, there do not appear to be geologic conditions in the Colstrip region that would endanger life or property in the future. Ground tremors caused by an earthquake might shake Colstrip once or twice a century, but would probably not structurally damage buildings.

Explosive discharges used to fracture overburden and coal would be monitored and would not exceed 1 inch per second maximum potential velocity at the nearest dwelling 2 miles away. As such, mining and blasting would not in all probability cause structural damage to buildings or trigger earthquakes in the region.

Geologic Resources

Forty-four million tons of coal in the Rosebud coal seam are estimated to be within the bounds of the Western Energy Area B extension. Western Energy estimates that 96 percent, or 42.2 million tons, of coal would be recovered; 14.4 million tons of McKay coal would be left in Area B. It is extremely unlikely that the McKay coal seam would ever be mined once the overlying Rosebud is removed. Additional coal seams lie farther below the surface, but are unminable under current economic conditions.

Other geologic resources of Area B have very low economic value or potential. (See chapter II, Geology, Geologic Resources.) Mining of Area B would not seriously affect future uses of the noncoal resources of the region.

HYDROLOGY

Note: The new and revised text in this section has not been underlined, as in other sections, because most of the section has been revised since the draft. The purpose of leaving out the underlining (in this section only) is to make the text more legible.

Summary of Impacts: Mining would double to triple total dissolved solids (TDS) in the extension area's ground water. This TDS increase, together with increases from other permitted mining, could in turn double TDS concentrations in East Fork of Armells Creek alluvial ground water. This increase, bringing alluvial TDS concentrations to 5,000 mg/l, could last for thousands of years. Assuming premining ground water flows resume after mining, the Area B extension would account for 10 to 50 percent of the total increase. Seepage from industrial waste-water ponds would further increase TDS concentrations in the East Fork of Armells Creek alluvium downstream of Colstrip for 50 to several hundred years.

Added together, all Colstrip-area development could, during low-flow periods, limit the use of the East Fork of Armells Creek downstream of Colstrip for stock watering. Area B ground water, in contrast, would be usable for stock watering, the primary postmining water use. Cumulative development could also reduce plant productivity and change species composition on lowlands next to the East Fork of Armells Creek. How far changes could extend downstream is not known.

Ground Water--Changes in the Extension Area During Mining

Mining completed since the opening of Areas B and A has modified the quantity and movement of ground water in the Area B extension. Opening of mine pits has lowered ground water potentiometric levels in overburden and coal up to one mile away. (The potentiometric level is the height to which water would rise in a well.) The same would occur during mining of the Area B extension, but the area influenced would increase, extending about two miles farther west (upstream) than at present.

During mining, ground water would flow into the extension area mine pit. Initial pit inflow would occasionally be high, up to 320 gallons per minute (gpm), as ground water drains from saturated geologic units next to the pit. Inflows would drop off with time, as shown in table III-1, but would remain high for the first half year. As mine spoil, during the second pass of the dragline, is placed back into the boxcut (first pit of the mine), pit inflow rates would drop to less than 80 gpm. (Note that these estimates are lower than those reported in the draft EIS. The draft extimates assumed the pit would be opened all at once; the new estimates assume the pit would be opened gradually, a more realistic assumption.)

Highest pit inflows would occur during initial pit (boxcut) opening. The first pit would intersect 300 feet of the East Fork of Armells Creek alluvium in the northwest quarter of section 8. Roughly 90 gallons per minute would initially flow into the pit from the alluvium. Added to this would be water flowing through the Rosebud overburden, Rosebud coal, and ephemeral tributary alluvium. (See table III-1.)

Table III-1

Estimated Area B Boxcut Inflows
(Sections 7, 8, 17, 18)

[Source: Pete Norbeck, Western Energy Company, written commun., 1982]

Pit Segment	Unit	1 day	12 days	22 days	40 days	90 days	180 days
0-400	Rosebud Coal	2.5	0.7	0.5	0.4	0.3	0.2
	EFA* Alluvium	3.4	1.0	0.7	0.5	0.4	0.3
400-620	Rosebud Coal		0.5	0.3	0.2	0.2	0.1
	Overburden		0.4	0.3	0.2	0.1	0.1
	EFA* Alluvium		2.6	1.8	1.3	0.9	0.6
620-1320	Rosebud Coal		7	4.6	3.2	2.1	1.4
	Trib. Alluvium		6.5	4.2	2.9	1.9	1.3
	EFA* Alluvium		13	8.2	5.7	3.7	2.6
1320-2430	Rosebud Coal		44	13	8.2	5.1	3.4
	Overburden		6.9	2.1	1.3	0.8	0.5
	EFA* Alluvium		70	21	13	7.8	5.3
2430-3540	Rosebud Coal			20	9.3	5.2	3.5
	Overburden			3.1	1.4	0.8	0.5
	EFA* Alluvium			23	11	5.9	4.0
3540-4280	Rosebud Coal			48	11	5.7	3.8
	Overburden			5.2	1.2	0.6	0.4
	Trib. Alluvium			14	3.3	1.7	1.1
	EFA* Alluvium			17	3.9	2.0	1.3
4280-5380	RC** & Trib. Alluv.				18	8.2	5.3
	EFA* Alluvium				0.9	0.4	0.3
5380-6580	RC** & Trib. Alluv.				27	9.4	5.9
	EFA* Alluvium				10	3.6	2.3
6580-7680	RC** & Trib. Alluv.				65	9.1	5.5
	EFA* Alluvium				16	2.2	1.3
7680-8780	Rosebud Coal					1.1	0.7
7680-7800	EFA* Alluvium					0.1	0.0
8780-9980	Rosebud Coal					1.3	0.7
9980-11180	Rosebud Coal					1.5	0.8
Calculated inflows (gpm)		3-9	77-230	94-281	108-323	41-123	27-180

*East Fork of Armells Creek
**Rosebud Coal

At present, water flow through the overburden of Area B is roughly 10 to 25 gpm. Some of this flow contributes the alluvial ground water of the East Fork of Armells Creek. Loss of this ground water inflow could reduce the flow in the East Fork of Armells Creek alluvium by 15 to 35 percent. As a result of combined alluvial and overburden flows into the pit, water levels in the alluvium next to and downstream of the mine would be slightly lowered for a distance of 3 to 4 miles. The alluvium would be unaffected beyond this distance, because of inflow from industrial and municipal development. The lowered levels in the alluvium could reduce vegetative productivity on the lowest terrace along the creek for a year or so. Since this area is neither grazed nor hayed, the slight, temporary drop in vegetative productivity would not be significant.

Western Energy would have some operational problems in dealing with high initial pit inflows. In the past, pit walls collapsed in Area B when the pit bordered the East Fork of Armells Creek. A similar hazard would exist where the extension area extends into saturated alluvial gravels and overburden. (See Mitigating Measures.)

The pit must be kept free of water during coal removal. Ground water running into the pit would therefore be pumped to either existing Area B sedimentation ponds, to an inactive portion of the pit, or to temporary retention ponds. Most of the water would be released to the East Fork of Armells Creek at authorized MPDES (Montana pollutant discharge elimination system) discharge points or would be lost to evaporation and infiltration. During summer and early fall, some of this water would be sprinkled on roads to suppress dust.

Mining of the extension would also lower ground water levels in the Rosebud coal seam and, to a smaller extent, in the Rosebud overburden and McKay coal seams upgradient (west and southwest) of the mine. Drawdown effects in the Rosebud coal would probably extend up to one mile upgradient (Dollhopf, et al., 1979). A drop of 5 to 10 feet at distances of 2,000 feet could be expected (Montana Department of State Lands [MDSL] and U.S. Office of Surface Mining [OSM], 1982b, p. III-9). As a result, mining could temporarily dry up one private well located about one-quarter mile west of Area B (northeast quarter of section 13). If this were to occur, the company would be required to replace the well.

Ground Water--Changes in Area B After Reclamation

Using a predictive relationship (MDSL and OSM, 1983b), spoil water in Area B after mining would average about 2,800 mg/l TDS and range from 1,800 to 3,850 mg/l. Area B spoil water is expected to be of slightly better quality than other spoil water at the Rosebud Mine (average 2,984 mg/l TDS). Even so, the Area B spoil water would probably contain TDS values two to three times those now found in the unmined Rosebud coal seam and in the undisturbed Rosebud overburden. (The coal seam and the overburden together average about 850 mg/l TDS in Area B.)

Four wells and one spring would be removed by mining. Three wells are used for stock watering; the fourth is abandoned. Of the three active wells,

one is completed in Rosebud coal, another in alluvium, and the third in sub-McKay. The spring that would be lost lies in the northeast corner of section 8. The spring's flow varies from 0 to 10 gallons per minute (gpm). The quality of water is good, averaging 680 mg/l total dissolved solids. Since mining would remove the overburden and alluvium feeding the spring, the spring probably would not resurface after reclamation.

Western Energy stated in the Area B permit application that the lost wells and springs would be replaced with sources producing an equal quantity and quality of water. Western Energy Company would be able to find sources with equal quantity. But quality of the overburden and spring may be difficult to duplicate. Water of this quality is rare in eastern Montana. Fortunately, the sub-McKay under Area B has water of quality only slightly higher in TDS levels than the overburden in section 8 (well WO-100 = 946 mg/l TDS and well WD-160 = 890 mg/l TDS). This sub-McKay water, although above the 500 mg/l recommended limit for drinking water, would still be drinkable. In fact, drinking water of this quality is used in many parts of eastern Montana. The sub-McKay would remain of high quality as long as mine spoil water does not leak down from higher strata, a process that would raise TDS levels.

Deterioration of water quality in the extension area would probably not be critical, since the potential need for domestic water supplies in this area is low. The past and projected postmining land use in Area B is livestock grazing. Thus, even the spoil water in Area B could be used for stock watering. Cattle can safely drink water containing up to 7,000 (dairy) to 10,000 (beef) mg/l TDS; horses can safely drink water containing less than 6,400 mg/l TDS (McKee and Wolf, 1971). Research has found that higher TDS concentrations can cause noticeable adverse effects in young or lactating livestock (U.S. Environmental Protection Agency, 1973). Although the livestock could drink spoil water in the range of 3,000 to 4,000 mg/l TDS, the animals would have to drink more and thus stay closer to water sources than before mining (National Academy of Sciences, 1974, p. 39).

Western Energy proposes to replace two of the four stock wells now in Area B extension with wells completed in the sub-McKay aquifer. To replace the spring, the company proposes to install another well equipped with a windmill and stock tank. The three wells would probably be adequately spaced and produce enough quantity to adequately support the intended postmining land use of livestock grazing.

Boron, a trace element, occasionally exceeds the water quality standard (0.75 mg/l) for irrigation and domestic water supplies. Boron concentrations of mine spoil are about the same as natural levels found in near-surface ground water and in surface waters around Colstrip. As such, mining has not and is not be expected to increase boron levels in ground or surface waters. (See table III-1a.)

TABLE III-1a
Boron Concentrations in Colstrip Area Waters
(mg/l)

[Source: Western Energy Company, 1983]

Hydrology System	Number of Analyses	Mean	Range
Spoils	24	.63	.17-1.23
Combined near-surface water-bearing strata	60	.76	.17-2.04
Surface Water, East Fork of Armells Creek	14	.61	.2-1.23
Surface Water, Cow Creek[1]	16	1.8	1.1-3.7

[1]USGS monitoring site at mouth of Cow Creek. Period of record: October 1979 to January 1983.

When the flow of ground water resumes after mining ends, a maximum of 10 to 25 gpm could pass through Area B extension mine spoil, roughly equaling the amount now passing through the overburden (10 to 20 gpm) and Rosebud coal (2 to 3 gpm). This is more than the estimated flow through mine spoil of all other permitted Rosebud Mine areas combined (5-10 gpm). Should this much ground water flow through the Area B extension, the Area B mine area could potentially be the single largest contributor to postmining TDS increases in the East Fork of Armells Creek alluvium.

Mine spoil in the extension could further increase TDS values in adjacent mine spoil (permitted mine areas B and E). Generally, the more mine spoil that ground water flows through, the greater the increase in TDS levels because of dissolution of salts available in the spoil. The additive effect of ground water passing through successive units of mine spoil has not been fully researched. But wells drilled by Western Energy show that TDS levels increase from premining levels of 1,000-1,500 mg/l to about 3,000 mg/l upon passing through mine spoil. Downgradient, a further dissolution of salts could increase to TDS levels up to 4,000 to 5,000 mg/l. TDS levels probably would not rise any higher, because--

(1) water in existing mine spoil at the Rosebud Mine rarely exceeds 5,000 mg/l in total dissolved solids.

(2) research indicates that some ground-water constituents in the spoil water would reach saturation, thereby preventing continually rising concentrations of dissolved solids (Plummer et al., 1978; Van Voast et al., 1978b).

(3) the initial flush of water through spoil would probably remove a high percentage of available salts, allowing water quality to improve with time (Van Voast et al., 1978b).

Ground Water--Use Downgradient of Area B

Users of bedrock ground water and East Fork of Armells Creek alluvial ground water downgradient of Area B extension would not be appreciably affected by the extension. Although past and ongoing mining will preclude development of shallow domestic water supplies downgradient of Area B (near the mine) this would happen regardless of whether or not the extension is mined. In any event, the most likely postmining use of ground water is for livestock. For this purpose, wells could be completed in mine spoil or deep aquifers.

Surface Water--Changes During Mining

Eleven sedimentation ponds would be built in Area B to remove sediment from runoff, thereby confining water quality changes to the mine area. (See fig. I-6.) Ground water flowing into the mine pit would be pumped to one of the sedimentation ponds or to a temporary holding pond and then be released to the East Fork of Armells Creek. Western Energy has received permits for such discharges from the Montana Department of Health and Environmental Sciences, Water Quality Bureau. The permits establish criteria that must be met before the water can be released. The discharge of pit pumpage water would not adversely affect the quality of water in the East Fork of Armells Creek.

Pit pumpage could reach 300 to 400 gallons per minute as the boxcut is opened in the Area B extension. Release of this water to the East Fork of Armells Creek would not appreciably change the flow during spring (high-flow) runoff, but releases during low-flow periods (which occur during roughly 9 to 11 months each year) would increase flow by at least 50 percent.

The large amounts of pit water released could add to the quantity of water in the alluvium of the East Fork of Armells Creek, thereby raising ground water levels downstream. Higher alluvial ground water levels would probably compound waterlogging problems of hayfields downstream, primarily at the Lee and Kazelka Ranches. (See Mitigating Measures and chapter II, Hydrology, Ground Water, Man-Induced Changes.) Such effects would not be significant after about six months, since the amount of water released would then drop considerably. The exact timing and quantity of these releases cannot be determined because the date that Western Energy would begin mining is unknown.

The ponds in the Area B extension would temporarily impound from 10 to 20 percent of the total surface water runoff in the East Fork of Armells Creek drainage above Colstrip. This would lower peak flow downstream. The loss of peak runoff water would not adversely affect flood irrigation downstream, since high flows are generally more than sufficient for flood irrigation.

Surface Water--Changes After Reclamation

The quality of surface water at low flow in the East Fork of Armells Creek could be affected as a result of mining-induced changes in the quality of ground water. Standing and low-flow water of the East Fork of Armells Creek above Colstrip is a result of alluvial ground water inflow. The doubling of

alluvial TDS concentrations as a result of mine spoil water inflow would probably double low-flow surface water TDS concentrations in some areas. Evaporation of water would further raise TDS levels. As a result, low-flow TDS concentrations could exceed the threshold for livestock watering, rendering the water useless during certain periods of the year. Livestock would have to use water from wells and springs.

Sedimentation ponds would be left in place for at least 10, and on the average 20, years after the disturbed areas above them are revegetated. Surface water discharges from sedimentation ponds must meet Department of Health and Environmental Sciences criteria. Discharges from sediment ponds in Area B are expected to be of good quality and undetectable in the East Fork of Armells Creek.

By law, before sedimentation ponds in any mine can be removed, the postmining erosion rates cannot be higher than the premining rates. As such, the surface waters of the East Fork of Armells Creek would be protected. All but one sedimentation pond in the Area B extension area would be removed once the mine area has been successfully revegetated. The one pond left would be used for stock watering.

By removing the sediment load from runoff waters and attenuating peak runoff from the ephemeral drainages, the sedimentation ponds could slightly modify stream channels. The most noticeable channel changes would probably occur once the sedimentation ponds are removed:

(1) Sediment stored along the ephemeral channel upstream of the ponds would be subject to renewed erosion. (The sediment would have been transported downstream over the 10- to 20-year period if the ponds had not been built.)

(2) Downstream of the ponds, the undersized channels would again carry peak flood flows, which would rewiden the channels, causing increased sediment loads downstream for up to several decades (MDSL and OSM, 1982b).

These two phenomena would increase suspended sediment load and bedload of water downstream. After the ponds are removed, the sediment would move downstream in large pulses during high water. Adverse effects would probably be minimal, because the changes would be fairly localized.

The gradual development of gullies and draws on the postmining landscape (see Geology) would increase sediment in runoff waters of the ephemeral drainages of Area B, but would probably not be detectable in the East Fork of Armells Creek, since the creek is much bigger. The added sediment in the small ephemeral creek downstream of the newly formed draws and gullies could cover existing stream bottom vegetation, but such changes would be so localized as to be insignificant.

Cumulative Hydrologic Effects of Mining Area B (7, 8, 17, 18)

Mine spoil would double to triple the level of TDS in ground water within the Area B extension mine area. The spoil water would largely remain within the permit area prior to final reclamation. Following reclamation, spoil water would gradually flow northeast and southeast, away from the mine.

Some of the estimated 10 to 25 gpm of spoil water from the extension would move directly toward the East Fork of Armells Creek, reaching the creek within centuries. But most would move east and north through existing spoil, eventually reaching the creek through a much longer path. This water would take 10,000 or more years to reach the creek. The net effect of extension spoil water flow into the creek would be an increase of 10 to 50 percent in TDS levels, from 2,500 mg/l to as high as 3,000 to 3,700 mg/l.

Existing and soon-to-be-created-spoil in permitted mine Areas A, E, and B, will also add salts to the East Fork of Armells Creek alluvium. The combined effect of these mine areas and the pending Area B extension would probably raise TDS levels in the East Fork of Armells Creek alluvium to over 5,000 mg/l, double premining TDS concentrations. In the future, Western Energy proposes to expand into new parts of Areas A, C, and a portion of Area D. Further increases in TDS concentrations are likely to occur upstream and downstream of the Area B extension, although the cumulative TDS levels due to mining would probably not exceed 5,000 mg/l. (See MDSL and OSM 1983b, section 3.2.3.).

Industrial waste-water pond seepage, along with mine spoil seepage from Area A, has increased salts in the East Fork of Armells Creek alluvium downstream of Colstrip. TDS concentrations before mine development were under 3,000 mg/l, but are now over 4,500 mg/l and, in some cases, over 5,000 mg/l. Industrial pond seepage could further increase TDS levels, raising them well above 5,000 mg/l downstream of Colstrip. The ponds will continue to add salts to East Fork of Armells Creek for several hundred years after they are no longer used; it could take several centuries before the mound of degraded ground water under the ponds dissipates. (See MDSL and OSM 1983b, section 3.2.3.) Mining-related TDS increases in the alluvium of the East Fork of Armells Creek, in contrast, would last much longer, at least 10,000 years.

If flow in the Rosebud overburden and Rosebud Coal seam were to reestablish in the spoil after mining, the Area B extension would be a major contributor to TDS increases from the mine. But how much of the 10 to 25 gpm premining flow would reestablish through the spoil is not known. (For comparison, the total estimated flow through all the existing and projected mine areas at the Rosebud Mine, excluding Area B (sections 7, 8, 17, 18), is only 5 to 10 gpm.) If the source of Area B extension overburden input water (e.g., infiltration of ephemeral stream water into underlying strata) is largely eliminated by mining, the postmining flow through the spoil could be substantially less. If, on the other hand, the source of the ground water is upgradient of the mine, the flow would probably be maintained through the spoil.

Throughout the Rosebud mine area there is a slight but persistent downward movement of ground water. Although the Rosebud-McKay interburden and the McKay coal seam as a general rule do not transmit much ground water, locally they have appreciably higher transmissivities and may therefore allow deeper penetration of spoil water. As a result, mining of the Area B extension and other mine areas of the Rosebud mine could, together, increase TDS levels in ground water below the Rosebud coal and spoil.

This increase in TDS levels could have two effects. First, since ground water in the strata below the Rosebud coal and spoil flows mostly east toward Cow Creek, spoil water from Area B extension could add slightly to the salt loading of the Cow Creek drainage. Second, the lower water quality might preclude development of shallow domestic water supplies near Colstrip. At present, domestic water supplies are primarily supplied by imported Yellowstone River water. Loss of Yellowstone River water could lead to an increase in demand for shallow domestic water supplies.

The Area B extension would not increase TDS levels in the Cow Creek drainage as much as mine spoil from Area E, Area B, and Pit 6. Most of the Area B extension mine spoil water would end up in the East Fork of Armells Creek. Any Area B extension spoil water seeping into the sub-Rosebud coal and spoil water-bearing strata would have to travel over three and one-half miles before reaching the Cow Creek drainage. The spoil water from the extension would not reach the Cow Creek drainage for a minimum of 1,000 years and could take as long as 20,000 years (rate of flow = hydraulic conductivity in feet per day X slope of potentiometric surface [U.S. Geological Survey and MDSL, 1980, p. IX-71]). As such, the Area B extension would not increase TDS levels, but would merely extend the length of time degraded water is added to this drainage. Additional salts from mine spoil could reduce vegetative productivity of the lower-level stream terraces near the mine (MDSL and OSM, 1983b, section 3.2.1.1.2).

A small amount of spoil water from Area B extension (60 acres) and Area C, Block II, (510 acres) would move toward the southeast and the Big Sky Mine. The spoil water would degrade slightly the quality of ground water before passing through mine spoil of the Big Sky Mine. The TDS levels just above the Big Sky Mine would be about 1,000 to 1,500 mg/l higher than without mining.

Spoil water from Area B and Area C would take thousands of years to get to the Big Sky Mine drainages. Meanwhile, the Big Sky Mine spoil would degrade surface and alluvial ground water quality of creeks located to the east. Rosebud Mine spoil water would reach the Big Sky Mine about the time the influence of the Big Sky Mine had mostly dissipated. Thus, the Rosebud Mine spoil probably would not appreciably increase overall TDS concentrations, but instead would extend the length of time TDS concentrations would be elevated in Coalbank, Miller, and Lee Coulees.

Interception of ground water by all mine pits at the Rosebud Mine would not appreciably change water flow in the East Fork of Armells Creek, Pony Creek, Cow Creek, South Fork Cow Creek, Hay Coulee, Coal Bank Coulee, Miller Coulee, or Lee Coulee. At most, the total flow in the East Fork of Armells

Creek would decrease by 4 percent, in Stocker Creek by 2 percent, in Pony Creek by 0.2 percent, and in Cow Creek by less than 0.1 percent. (Montana Department of State Lands [MDSL] and U.S.D.I., Office of Surface Mining [OSM], 1982b, p. III-11; MDSL and OSM, 1983). These changes are not considered to be significant.

Mitigating Measures

Selective placement of saline overburden would reduce TDS level increases in postmining spoil water. Selective placement techniques using draglines have been successfully demonstrated in Area B. But the techniques did increase operating costs by about 12 percent (Dollhopf et al., 1981). (See also Final Comprehensive Environmental Study of Western Energy's Rosebud Mine [chapter III, Mitigating Measures, MDSL and OSM, 1983b] for more information regarding selective placement.)

Dewatering of alluvium and overburden adjacent to the East Fork of Armells Creek several months prior to opening of the mine in the Area B extension would help reduce the hazard of pit wall failures and help facilitate coal removal. Numerous pumping wells completed in these strata would lower ground water levels gradually prior to mine pit opening. This would substantially lower pit inflows and maintain lower water levels in the strata adjacent to pit. Western Energy submitted a detailed dewatering plan to the Department of State lands and the Office of Surface Mining, but the plan was rejected because it was submitted as an amendment to Western Energy's existing permit for sections 4, 9, 10 and not made as part of the pending section 7, 8, 17, and 18 permit application. Western Energy will probably submit an application to amend the pending application to incorporate such a dewatering plan.

The extra water from the dewatering plan, along with possible pit pumpage, could aggravate alleged waterlogging problems on the East Fork of Armells Creek. To avoid waterlogging, ground water from the pit or dewatering plan could be consumptively used. That is, instead of discharging to the East Fork of Armells Creek, Western Energy Company could (1) use the water to sprinkle haul roads, (2) allow the water to evaporate, or (3) retain the water in special retention ponds.

SOILS

Summary of Impacts: Once respread during reclamation, the soils in the proposed disturbance area would present few limitations to the growth of new vegetation. Some impacts to soils would be unavoidable during soil salvage, replacement, and some stockpiling. The impacts could result in increased sensitivity of the disturbance area to mismanagement and drought for an unknown period of time after mining.

Soil Quantity and Quality

Western Energy proposes to salvage 4,610 acre-feet of topsoil and subsoil in two lifts from the Area B extension, providing an average soil cover depth after reclamation of about 34 inches. (See table III-2.) Based on soil data from the entire Rosebud Mine, this volume appears optimistic. For each soil series at the mine, the depth of salvageable soil above an unfavorable layer (i.e. excess salts, clay, or gravel) varies. By averaging the depth to unfavorable layers for each series using data from the entire mine, the soil salvage volume for the Area B extension is reduced to 3,591.5 acre-feet, yielding an average depth of about 27 inches. (See "potential" column in table III-2.) Either the proposed or potential volumes would provide adequate soil cover. Actual volumes and depths would probably fall in between the two estimates, and would depend on the presalvage sampling program discussed below.

As in some of the other Rosebud Mine areas, Western Energy would implement a presalvage sampling program for soils that are suspected of having unfavorable texture or excess salt. Soils would be sampled approximately every 400 feet in the areas containing suspect soils. They would be sampled to a depth six inches deeper than the company's proposed salvage depth. Each sample would be divided into six-inch increments for analysis. If analysis indicates excess salts or unfavorable textures, depth stakes would be placed to direct the scraper operator to avoid the problem layers. This practice would maximize soil salvage volumes while minimizing salvage of unfavorable material.

Sandy-textured soils cover large parts of the proposed disturbance area (table III-2). Western Energy would separate these from other soils and respread them only on slopes of less than 10 percent and outside drainages. This would prevent significant soil loss from erosion.

The overall quality of the redistributed soils would be less than that of undisturbed soils. This would result from some loss of organic matter and microorganism populations, the disruption of pore continuity, and the breakdown of soil structure. These unavoidable soil impacts would be reduced by Western Energy's plan to haul soil directly (without storage) to regraded reclamation areas when weather and field conditions permit.

VEGETATION

Summary of Impacts: 1,627 acres of vegetation would be destroyed by mining over a period of 8 years. Reclamation would reestablish plant communities primarily of native species. Rangeland forage production would probably increase; however, plant diversity would be lower for probably several years after mining.

TABLE III-2

Soil Resources in the Proposed Disturbance Area of the Area B Extension

Mapping Unit Name[1]	Approximate Soil Salvage Depths[2] (feet) Proposed[3]	Potential[4]	Acres	Approximate Soil Salvage Volumes[2] (acre-feet) Proposed[3]	Potential[4]	Primary Limiting Factor
Ustic Torriorthents	3.5	3.5	70.3	246.1	246.1	Excess salts
Busby fine sandy loam	2.5	1.0	428.0	1,070.0	428.0	Excess sand
Kremlin loam	4.5	4.5	205.8	926.1	926.1	None
Lonna silt loam	4.0	3.0	160.4	641.6	481.2	Excess salts
Spang sandy loam	2.5	1.0	5.5	13.8	5.5	Excess sand
Yamac loam	3.5	3.5	209.9	734.7	734.7	Excess salts
Kobar silty clay loam	3.0	3.0	18.8	56.4	56.4	Excess salts
Vanstel silt loam	2.0	2.0	192.9	385.8	385.8	Excess salts
Cabbart loam	1.5	1.5	12.9	19.4	19.4	Bedrock
Delpoint loam	3.0	2.0	2.0	6.0	4.0	Excess salts
Havre loam	1.5	2.0	0.9	1.4	1.8	Excess salts
Birney-Cooers-Kirby Complex						
Birney gravelly loam part	0.5	0.5	4.6	2.3	2.3	Excess gravel
Cooers loam part	0.5	3.0	4.0	2.0	12.0	Bedrock
Kirby channery loam part	0.5	0.5	2.8	1.4	1.4	Excess gravel
Birney-Kirby-Cabbart Complex						
Birney gravelly loam part	0.5	0.5	0.8	0.4	0.4	Excess gravel
Kirby channery loam part	0.5	0.5	0.5	0.3	0.3	Excess gravel
Cabbart loam part	0.5	1.5	0.5	0.3	0.8	Bedrock
Busby-Reidel Complex						
Busby fine sandy loam part	2.0	1.0	168.1	336.2	168.1	Excess sand
Reidel sandy loam part	2.0	1.0	72.0	144.0	72.0	Excess sand
Cabbart-Yawdim-Rock outcrop complex						
Cabbart loam part	0.5	1.5	22.6	11.3	33.9	Bedrock
Yawdim silty clay loam part	0.5	0.5	22.6	11.3	11.3	Excess clay
Rock outcrop part	--	--	22.6	--	--	--
		TOTALS	1,628.5	4,610.8	3,591.5	

[1] Although separated during the soil survey due to slope differences, mapping units containing the same soil series were combined in this table for purposes of clarity. This does not affect proposed or potential soil salvage depths or volumes.

[2] Actual salvage depths and volumes would be determined in the field during Western Energy's proposed presalvage sampling program. The figures listed in the columns include both topsoil and subsoil combined, although the soil would actually be salvaged in two lifts.

[3] Proposed by the Western Energy Company in its Area B permit application.

[4] Potential based on review of all available soil data for each soil series from the entire Rosebud Mine.

Discussion of Impacts

Postmining forage production from native range species would most likely exceed premining production levels, assuming proper range management and favorable growing conditions. The production increase would probably occur within a decade after planting. Postmining communities, however, would be less diverse than premining communities, owing to the lack of commercial seed sources for certain species and the more uniform variety of soil types and range sites that result after soil replacement.

Plant diversity is expected to increase with time. The rate of increase is dependent on the proximity of the reclaimed areas to undisturbed areas and the effectiveness of seed dispersal mechanisms of native plants in these areas. During soil replacement, some small sites could receive soils distinctly different from neighboring sites. The size and number of these microsites could also affect plant diversity, making diversity greater in some cases, less in others.

Many species now dominant in plant communities have assumed their positions because of past land uses and grazing practices. After mining, grass and shrub frequency would decrease for some species. This would generally be advantageous, since the reclaimed plant communities would contain species that more nearly reflect potential climax communities. The postmining range condition would thus improve over the premining condition, and recommended stocking rates would likely increase.

Native grass cover would increase after mining, due to the elimination of the disturbed grassland, gumbo knobs, corrals, and buildings now in the proposed disturbance area. According to the company's reclamation plan, total postmining shrub cover would be about 10 percent less than premining cover. But this figure could change considerably. Successful shrub growth, the natural invasion from surrounding undisturbed areas, and competition from reseeded grasses would affect shrub cover. Western Energy proposes to more than double the acreage of the ponderosa pine community in the disturbance area. However, since the success rate of ponderosa pine on reclaimed areas at the Rosebud Mine is roughly 50 to 60 percent to date, the actual postmining acreage would probably be similar to the premining acreage.

All reconstructed drainage areas would be planted with a lowland-drainage mixture (a mix of a few upland grasses with moisture-loving species). The proposed vegetation on the postmining areas could therefore contain more than ten times the amount of lowland-drainage species compared to premining vegetation. A major portion of the drainage areas now consists of disturbed grassland and various shrub types.

WILDLIFE

Summary of Impacts: Impacts to wildlife species would be minimal and localized. Species associated with the upland grassland habitat type would be most affected. Some nesting and brooding cover for sharp-tailed grouse may be lost along with pronghorn antelope range.

Description of Impacts

Habitat disruption would be the immediate impact resulting from mining. Over the life of Area B extension mining, 1,627 acres of existing wildlife habitats would eventually be disturbed. (See fig. I-2.) This makes up about 10 percent of the total Rosebud Mine disturbance area (Montana Department of State Lands, 1983b).

The company is proposing to use direct back haul, which would lessen the impact of habitat disruption. Reclamation and reestablishment of vegetative cover would begin as soon as feasible, shortening the period, and thereby reducing the effects, of habitat disruption.

During the first few years of extension area mining, species using upland grassland habitats would be primarily affected. Loss of upland grassland, which is characteristically less diverse than other habitats, would reduce (1) pronghorn antelope range, (2) potential nesting and brooding cover for sharp-tailed grouse, (3) potential habitat for small mammals, such as prairie voles, deer mice, and thirteen-lined ground squirrels, and (4) potential habitat for birds that use upland grasslands, including killdeer (Charadrius vociferus), western meadowlark (Sturnella neglecta), vesper sparrow (Pooecetes gramineus), and lark sparrow (Chondestes grammacus). Impacts on the approximately 6,400 acres of grassland within the entire Rosebud Mine would be similar to those impacts within the Area B extension (Montana Department of State Lands, 1983b).

The diverse habitats, such as ponderosa pine/grassland, and shrub habitats, such as big sagebrush/grassland and skunkbush sumac/grassland, would be destroyed primarily toward the end of the operation. The loss of relatively small acreages of these types is not expected to reduce wildlife population significantly, although both the tree and shrub habitats provide important browse areas during winter months. More tree and shrub habitat would be disturbed in other areas of the Rosebud Mine. Area C, for example, has over 12 times more tree and shrub habitat than does Area B extension (Montana Department of State Lands, 1983b).

A loss of potential habitat for primary and secondary cavity nesters, raptors, and other birds could be expected. But the loss of 27 acres of ponderosa pine grassland would not to be significant to local populations. Impacts on ponderosa pine vegetation would be greatest in Area D, where 1,135 acres would be disturbed (Montana Department of State Lands, 1983b).

A small mule deer wintering area appears to be located along Greenleaf Ridge (the sourthern border of the permit area). The proposed operation probably would have little effect on the wintering area. Temporary displacement may result as the operation nears the ridge. This effect would be minor. Although none of the Rosebud Mine is considered important winter range, most wintering deer have been observed on Area A (Western Energy Company, 1981; Montana Department of State Lands 1983b).

Mule deer use of creek bottoms appears to increase during the fall. Sightings on the East Fork of Armells Creek, for example, increase during autumn. Travel lanes to the creek bottom were not identified within Western Energy's permit application; the sightings may be of animals from either Area A or the proposed permit area. If mule deer have been traveling north to the creek through the proposed permit area, mining activity can be expected to disrupt such lanes. If movement to the creek is from across Area B, mule deer would be expected to increase energy expenditure. This would be required so that the animals could move around Area B operations or move to similar habitat elsewhere, if feasible. The increased energy expenditure probably would not result in significant changes in birth or death rates.

Initial mining disturbance would begin over 2.5 miles from an active golden eagle nest and proceed to the south in increments toward the nest. The displacement effect on the eagles from increased human presence should be limited because of the gradual nature of the increase. Visual separation of the nest and mine would also reduce impacts. Less than 5 percent of the average-size (42,000 acres) hunting territory (Jackman and Scott, 1975) would be lost to Area B extension mining operations. For comparison, Area C mining operations would disturb approximately 18 percent of this territory.

The proposed Area B extension permit area includes some coyote habitat. The mobility and adaptability of this species would probably make overall impacts insignificant. Effects on the small population of other predators would probably be minimal.

Currently, there is a spring within section 8 that could provide water to wildlife using the area. Mining activity would prevent use of the spring. Following backfilling and initiation of reclamation, the spring would be replaced with a windmill and stock tank with a trickle overflow pipe, floating platform, and escape ramp to increase wildlife use.

CLIMATE

Continued mining in Area B would not affect the climate. Particulate emissions would remain at or near ground level, and total emissions would be too small to affect either precipitation or radiation balance.

AIR QUALITY

Summary of Impacts: Mining in sections 7, 8, 17, 18 of Area B would not significantly affect present air quality. Close to the mining operation, however, average TSP levels would increase significantly, fluctuating widely each day.

Description of Impacts

Annual average total suspended particulate (TSP) concentrations from all mining at the Rosebud Mine were predicted by the Department of State Lands (MDSL) and the U.S. Office of Surface Mining (OSM) using the Ertec Mining Air Quality (EMAQ) model. The results are presented in figures III-1, III-2, and III-3, which give emissions from Areas A, B, C, and E combined. The figures show that future TSP concentrations in the Colstrip area would increase little, if at all, over levels measured in Colstrip in 1980 (MDSL and OSM, 1982). The air quality would remain as described in Chapter II.

TSP would be the only pollutant of major concern emitted by mining. The great majority of TSP would be noncoal dust from (1) heavy equipment movement on unpaved surfaces and (2) overburden handling by the dragline.

Coal stacking would be the only major source of coal dust. The combined stack for Areas A and B would emit 1,200 tons per year (MDSL, 1982, Technical Support Document). The crushing, conveying, and loadout operations would emit little coal dust. These sources would be equipped with RACT (reasonably available control technology).

Particulate would consist of large particles that fall to the ground close to the source. The TSP concentrations would decrease rapidly with increased distance from the mine.

EMPLOYMENT AND INCOME

Summary of Impacts: The extension of Area B would allow the continuation of--not increase--the number of jobs at the Rosebud Mine.

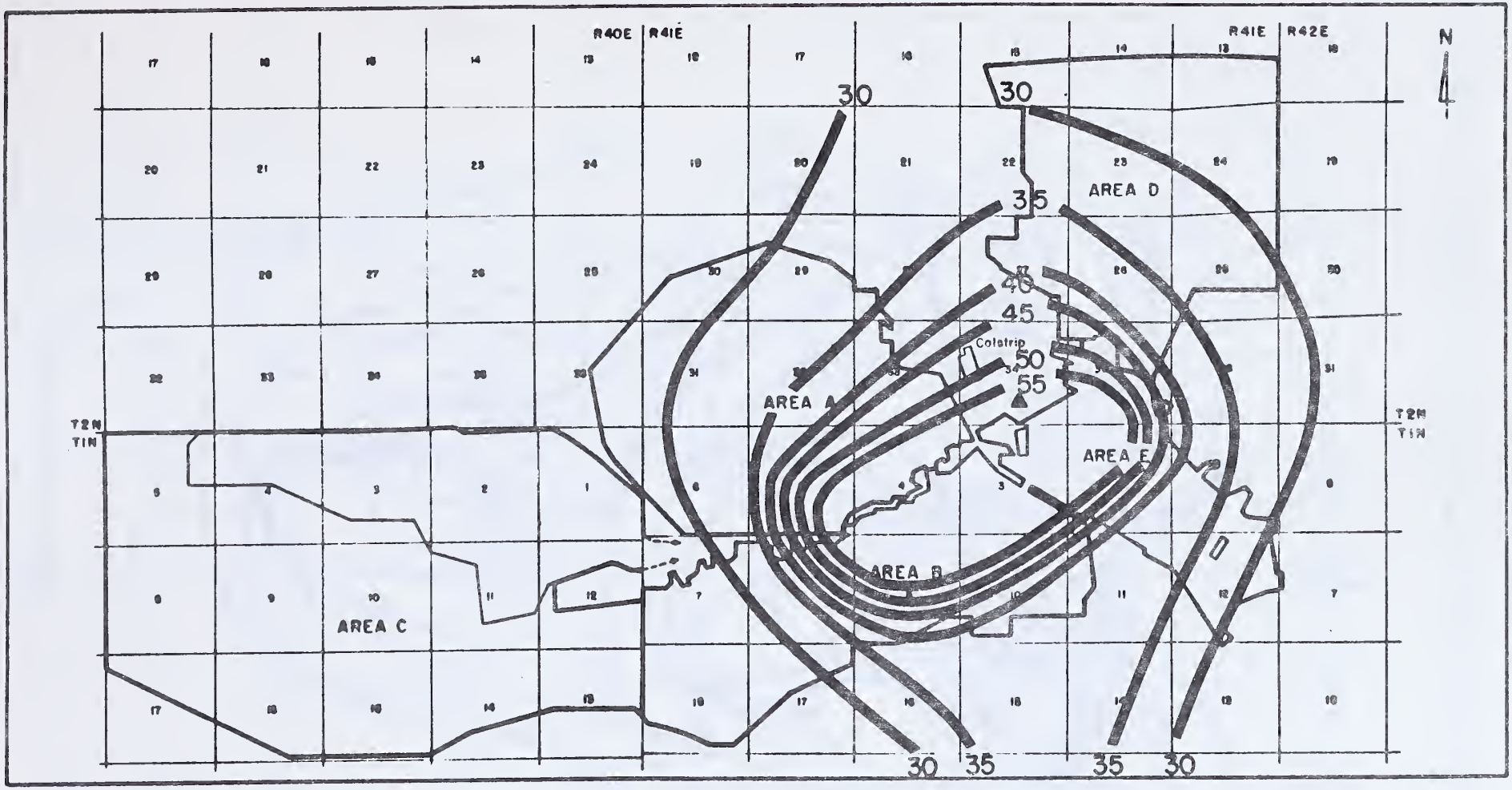


FIGURE III-1--TSP Concentrations in Colstrip Area in 1980

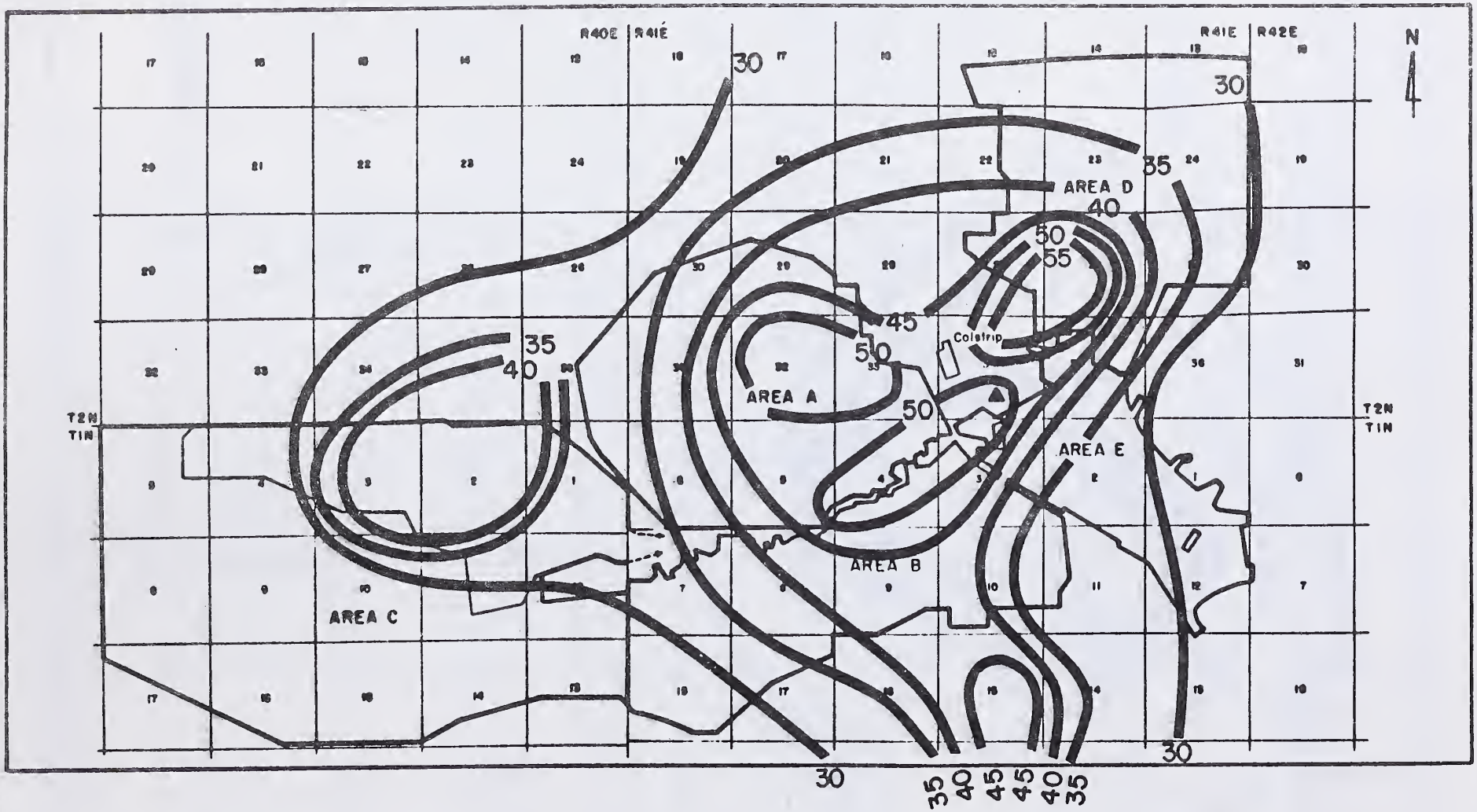


FIGURE III-2--TSP Concentrations in Colstrip Area in 1988

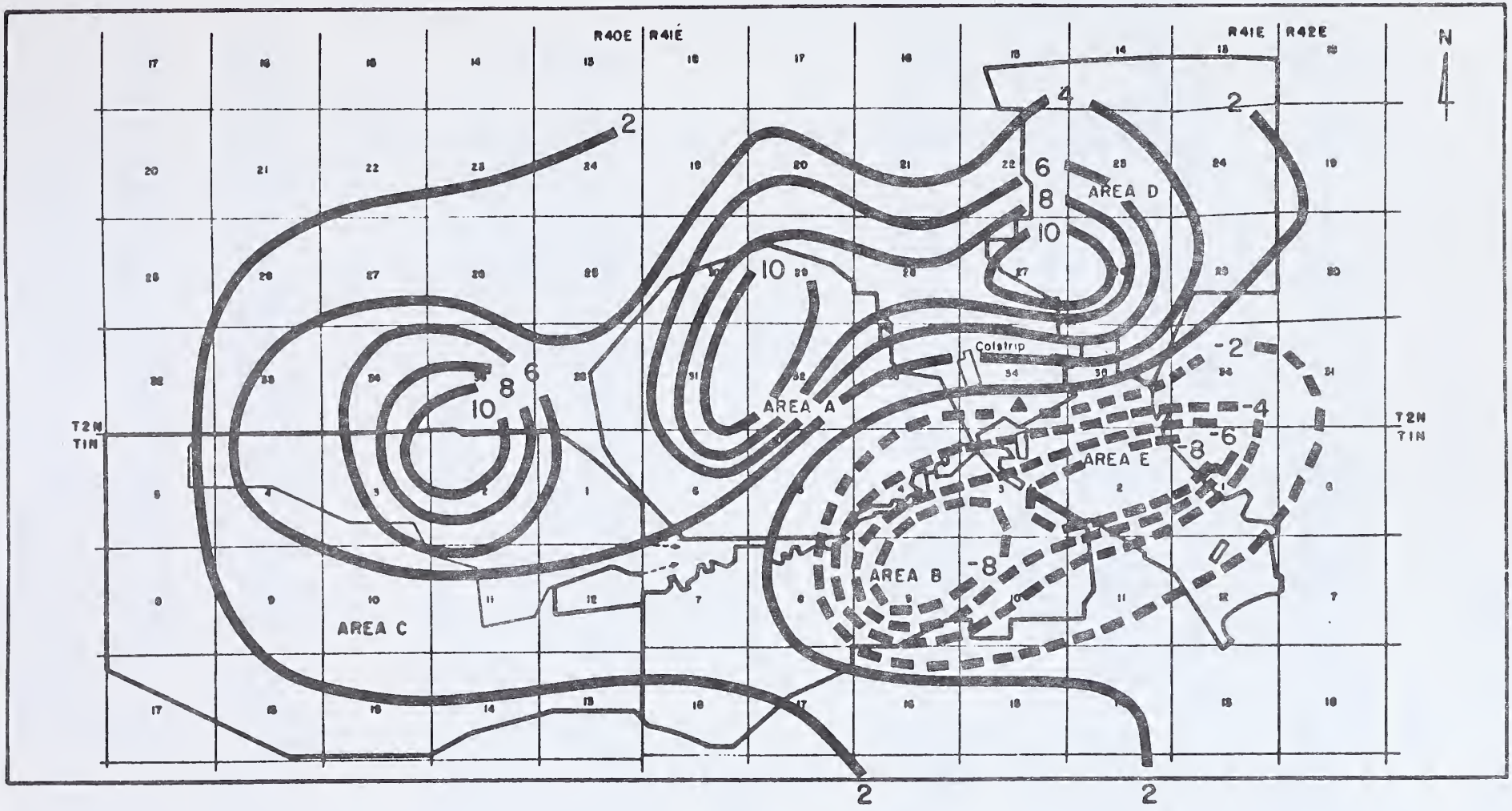


FIGURE III-3--The Increase in TSP Concentrations Between 1980 and 1988

Description of Impacts

Assuming that employment is perfectly proportional to production, the coal mined from the Area B extension would, over nine years, account for about 31 percent of the jobs at the Rosebud Mine. (See table III-3.) Employment at the mine is expected to grow to about 500 jobs. The proposed extension would support as many as 196 and as few as 121 of these jobs.

As total mine employment in Rosebud County grows, employment in the Area B extension would represent an ever smaller proportion of total mining employment. Even so, Area B's employees represent an integral part of the transformation that is increasing the importance of coal mining to the county's economy. (See table III-3.) The non-mine employment supported by the Area B extension workers would remain concentrated in Forsyth and Colstrip. Other nearby communities, such as Lame Deer and Ashland, would not be affected.

Workers in the proposed permit area would earn an average of about $28,280 per year (Jack Tomasik, Mountain West Research, Inc., oral commun., Oct. 13, 1982). The total payroll of the mine extension would be about $35.2 million.

SOCIAL CONDITIONS

Summary of Impacts: The population of Rosebud County, Colstrip, and Forsyth are projected to peak in 1983, decline through 1986, and remain relatively stable from 1986 through 1993. The percentage of the population attributable to Area B extension is and would remain small. The extension would probably contribute to the stability of Colstrip's social life, especially from 1983 to 1986, a period of rapid population decline.

Population

The extension of Area B would not create new jobs. Rather, Western Energy would transfer employees now working in the existing part of Area B to the proposed extension. The extension alone would not increase the population of Rosebud County, Colstrip, or Forysth.

The populations of Rosebud County, Colstrip, and Forsyth are projected to peak in 1983 and then decrease rapidly. The decrease would stop in the mid-1980s and a long period of uneven and slow growth would follow. (See table III-4.) The rapid decrease in 1983 would result from the decline in construction jobs following completion of Colstrip Generating Units 3 and 4 and not from a decline in mining employment. Area B extension employment begins in 1984.

TABLE III-3

Actual and Projected Mine Employment and Coal Production in Rosebud County

	Rosebud Mine								County Total	
	Area B				Total		Big Sky Mine			
	Extension		Total							
	Production**	Employment	Production**	Employment	Production**	Employment	Production**	Employment	Production**	Employment
1976	-0-	-0-	0.7	25	9.3	330	2.4	62	11.7	392
1977	-0-	-0-	3.7	125	9.8	332	2.3	62	12.1	394
1978	-0-	-0-	2.3	73	10.6	336	2.1	74	12.7	410
1979	-0-	-0-	1.6	49	11.7	356	2.5	88	14.2	444
1980	-0-	-0-	1.2	37	10.4	325	2.9	112	13.3	437
1981	-0-	-0-	5.5	172	10.4	325	3.2	112	13.6	437
1982***	-0-	-0-	7.0	200	11.4	325	3.2	112	14.6	437
1983	-0-	-0-	3.3	119	11.9	430	3.6	128	15.5	558
1984	6.2*	196	7.7	293	15.8	500	4.1	128	19.9	628
1985	4.1*	121	5.8	171	16.9	500	4.1	128	21.0	628
1986	4.4*	127	7.0	202	17.3	500	3.9	128	21.2	628
1987	6.2*	178	8.1	233	17.4	500	4.0	128	21.4	628
1988	5.7*	168	7.9	233	17.0	500	4.0	128	21.0	628
1989	5.4	157	8.4	245	17.2	500	4.0	128	21.2	628
1990	4.5	131	5.4	157	17.2	500	4.0	128	21.2	628
1991	5.7	166	5.7	166	17.2	500	4.0	128	21.2	628
1992	-0-	-0-	-0-	-0-	17.2	500	4.0	128	21.2	628

* Production covered in the proposed permit area.

** Millions of tons.

***From 1982 through 1992 the table presents projected figures.

TABLE III-4

Population of Rosebud County, Colstrip, Forsyth, and the Population Stemming from the Area B Extension*

Year	Area B** Work Force		Rosebud County Population		Colstrip Population		Forsyth Population	
	Extension	Total	Area B Extension	Total	Area B Extension	Total	Area B Extension	Total
1983	-0-	119	-0-	16,059	-0-	7,811	-0-	3,549
1984	196	293	685	14,886	549	6,617	98	3,413
1985	121	171	423	12,550	339	4,683	60	3,052
1986	127	202	444	11,573	356	3,866	63	2,890
1987	178	233	622	11,571	499	3,866	89	2,890
1988	168	233	587	11,644	471	3,884	84	2,904
1989	157	245	549	11,647	440	3,890	78	2,908
1990	131	157	458	11,671	367	3,895	65	2,913
1991	166	166	580	11,714	465	3,900	83	2.916
1992	-0-	-0-	-0-	11,754	-0-	3,916	-0-	2,917

* The population associated with Area B extension was calculated by (1) determining the percentage of Rosebud Mine's workers living in Rosebud County, Colstrip, and Forsyth; (2) assuming that Area B extension workers share the same residence pattern; (3) multiplying the number of Area B extension workers by the percentage expected to live in each area; and (4) multiplying the number of miners by 3.84 to determine how many miners, miner family members, ancillary employees and family members can be expected to live in an area. The 3.84 multiplier is an average of the multiplier used by Mountain West Research, Inc., in the Montco Draft EIS and Western Analysis, Inc., in the Rosebud Mine Area C Draft EIS. Further documentation of the techniques are on file with the Department of State Lands EIS Team.

**Total work force numbers were supplied by Western Energy Company. Area B and Area B extension employment were computed by multiplying the total number of Rosebud Mine employees by the percentage of Rosebud Mine's coal production that is produced by Area B and Area B extension.

The population stemming solely from the extension would not contribute substantially to population increases or decreases in Rosebud County, Colstrip, or Forsyth. The extension would not contribute to the 1983 peak population, would slightly moderate the decline up to 1986, and would add to the stability until 1991. Area B would contribute 5 percent to the County population in 1984 and 5 percent in 1987; 8 percent to Colstrip in 1984 and 13 percent in 1987; and 2 percent to Forsyth in 1984 and 3 percent in 1987. Area B's contribution to any of these populations would cease after 1991, the end of Area B mining. After 1991, the Area B employees are expected to work in another part of the Rosebud Mine.

Social Life

The extension of Area B probably would not adversely affect the social conditions in Colstrip. Only a small percent of Colstrip's population results from Area B now and no new staff would be hired for the extension. Thus, the miners and families now living in Colstrip and the surrounding area would continue to live there. These people would be in the area during the 1984-1986 period, thereby contributing to Colstrip's stability during a time of rapid population decline.

SOCIAL AND COMMUNITY SERVICES

Summary of Impacts: The population arising from Area B extension would continue to contribute to the strain on the services in Colstrip that are now inadequate. The inadequate services include housing and medical services. Even so, inadequacies in service would last only through 1985, after which Colstrip's population is projected to fall sharply, eliminating service deficiencies.

Description of Impacts

Fire protection, law enforcement, sewage disposal, water supply facilities, and solid waste disposal are adequate to serve Colstrip at the projected peak population in 1983. Upon completion of the Pine Butte Elementary School (1982), the educational services will also sufficiently serve the peak population. If the county social welfare department continues to receive Coal Board funding or acquires replacement funding for another two years (fiscal years 1984 and 1985), these services will also continue to be adequate.

Housing, and some medical services are likely to continue being insufficient for about two years. The Area B extension accounts for only a small percentage of the demand for these services, but does slightly extend the time and magnitude of service deficiencies. Deficiencies would cease after 1985.

FISCAL CONDITIONS

Summary of Impacts: Over the life of the Area B extension, school districts and State, Federal, and county governments would receive $155.9 million in tax revenues.

Description of Impacts

At 1981 coal prices and tax rates, the 42.2 million tons of coal that would be mined from the Area B extension would produce:

--$81.9 million in State severance taxes
--$30.5 million in Federal royalties
--$15.6 million in Federal Black Lung Excise taxes
--$14.8 million in Federal Abandoned Mine Reclamation taxes
--$11.8 million in local property taxes
--$ 1.3 million in State Resource Indemnity Trust taxes

The actual amounts paid would depend on the prices and tax rates in effect at the time of mining.

The greatest beneficiary of the tax revenues from the mine extension would be the State of Montana (68 percent of total revenues), which would receive all of the State severance taxes, half of the Federal royalties, about half of the Federal Abandoned Mine Reclamation taxes, a small part of the property taxes, and all of the Resource Indemnity Trust taxes. The Federal government would be the next greatest beneficiary (25 percent). Rosebud County and the Colstrip school districts would be distant third beneficiaries (7 percent).

LAND USE

Summary of Impacts: The Area B extension would temporarily displace grazing on 1,820 acres.

Description of Impacts

1,627 acres of the 1,820-acre Area B extension would be disturbed over 8 years. All of the disturbed land would be reclaimed to native rangeland. (See table III-5.) Postmining forage production from native range species would most likely exceed premining production levels, assuming proper range management and favorable growing conditions. (See Vegetation.)

TABLE III-5

Area B Extension Land Use Summary
(data are in acres)

[Source: Mike Shea, Western Energy Company, oral commun., February 16, 1983]

	Current Land Use	Expected Land Use Following Reclamation**
Permit area		
Total rangeland		
Native	1,585	1,807
Disturbed*	229	10
Corrals and ranchyard	6	3
Total	1,820	1,820
Proposed disturbance area		
Total rangeland		
Native	1,405	1,627
Disturbed*	219	0
Corrals and ranchyard	3	0
Total	1,627	1,627

* Areas that were farmed in the past and reseeded to introduced grasses and legumes.

**No area would be eligible to apply for bond release until at least 12 years after the beginning of mining.

The disturbance area would be out of normal production for at least 12 years--the amount of time that would pass before any part of the area would be eligible for bond release. Assuming that no grazing were to take place, the maximum potential loss in cattle production would total about 500 head over the 12-year period. Some test grazing, however, would take place on the reclaimed surface begining at the end of the revegetated land's third growing season to demonstrate the area's eligibility for bond release. The loss of potential cattle production would be less than the maximum.

TRANSPORTATION

Summary of Impacts: The extension of Area B would not noticeably change either train or highway traffic levels in Rosebud County.

Description of Impacts

Highway traffic is projected to rapidly decline from current levels following completion of Colstrip Generating Units 3 and 4. After 1985, the total amount of traffic due to the entire Rosebud Mine would remain relatively constant. Of the total, highway traffic due to Area B would vary with the coal production level, ranging between 200 and 320 trips per day. Based on the location of the homes of workers, about 95 percent of the highway traffic would be concentrated on the segment of FAP 39 north of Colstrip, less than 5 percent of the traffic would be on FAP 39 south of Colstrip, and a few trips per day would be on the graveled secondary roads leading to Colstrip.

Train traffic due to production from the extension would average between 1.6 and 2.4 loaded trains per day over an 8 year period.

RECREATION

Summary of Impacts: Since the extension of Area B would not increase population, no impact on recreation facilities or sites in or near Colstrip is expected.

Description of Impacts

All Colstrip facilities are now used to capacity and are considered inadequate to serve the existing population. Colstrip needs additional recreation space, indoors and outdoors. Even with the completion of Stillwater Park in 1983,

recreation needs will not be met. Only with the 45 percent decline in population that is projected upon completion of Colstrip Units 3 and 4 will long-term recreational needs decline (Montana Department of State Lands, 1982a, 1982b).

Recreation sites and facilities outside Colstrip would not be affected by the extension of Area B. These sites and facilities, including Tongue River Reservoir and the Ashland Division of Custer National Forest, can accommodate more use. The removal of the lands to be mined in the Area B extension would have no effect on recreation, since these lands are now closed to public use.

CULTURAL RESOURCES

Summary of Impacts: Mining would mainly affect resources found in the one-mile "buffer zone," or band, around the permit area: several homesteads may be damaged by blasting or vandalism; prehistoric sites may be vandalized or collected.

Description of Impacts

None of the 24 sites or isolated finds within the permit area are likely to contain information important to the prehistory of the area. Most of these sites would be destroyed by either mining or highwall reduction.

Blasting, vandalism, or unauthorized collecting may damage buffer zone sites. Table III-6 summarizes the potential impact on each site.

TABLE III-6

Possible Impacts to Cultural Resources in the Buffer Zone

Sites	National Register Eligibility	Impacts
Doc Taylor Place (24RB1062)	yes	Blasting, Vandalism, Arson
Muskrat Homestead (24RB313)	yes	Blasting, Vandalism, Arson
Sly Bison (24RB267)	yes	Vandalism, Collecting
Homestead Kill (24RB1014)	no	Vandalism, Collecting
West Homestead (24RB95)	potentially	Blasting, Vandalism, Arson
Picture Window Homestead (24RB392)	no	Blasting, Vandalism, Arson

Mitigating Measures

Since none of the sites within the permit area appear to contain information important to the area's prehistory, no mitigating measures are warranted for permit area sites (State Historic Preservation Office letter to Department of State Lands, October 22, 1981). In the buffer zone, however, the following steps should be taken by Western Energy Company to ensure no information is lost:

1. Take no action that would accelerate the natural deterioration of sites.

2. Record cultural data on the historic buildings, rock shelters, or rock art determined eligible for the National Register of Historic Places using maps, drawings, photographs, and analysis.

3. Monitor historic and prehistoric site conditions.

Each mitigation step must be coordinated with the State Historic Preservation Office to ensure adequate completion. Archeologists and historians have already begun step 2, data recording, having started with the earliest recordings of sites.

AESTHETICS

Summary of Impacts: Aesthetic impacts following reclamation would be insignificant. Within several decades after the completion of mining, neither the vegetation nor the topography of the postmining landscape would contrast with surrounding unmined land.

Description of Impacts

Mining of the Area B extension would disturb 1,627 acres of land over 11 years time. (At no point would all 1,627 acres be disturbed at the same time, since reclamation would proceed concurrently with mining.) During the operation, the same sights and sounds of adjacent mining operations would move into the extension area. Coal trucks, draglines, scrapers, and bulldozers, as well as two two-mile-long spoils piles, would be visible at all times.

During mining the color of the spoils piles would contrast with the color of the surrounding undisturbed rangeland and ponderosa pine stands. The mine machinery, particularly the dragline, would contrast with surrounding landforms. On the other hand, the spoils piles would repeat the form and line of the surrounding landscape.

The mining operation would be obvious from the county road along the East Fork of Armells Creek, which parallels the northern perimeter of the mine area. The operation would also be visible from Colstrip and a two-mile section of FAP 39. The visual impact on the views from these roads would be insignificant: similar sights and sounds are prevalent throughout the Colstrip area. In addition, similar or more scenic landscapes lie nearby Colstrip and throughout southeastern Montana.

Following mining, the disturbed land would be contoured into gentler slopes, with fewer knolls, ridges, coulees, and gullies, than the topography of the premining landscape. Highwall reduction would cut into some of the ponderosa pine covered bluffs along the southern edge of the permit area. The postmining topography would thus be less diverse and have less appeal than the premining landscape. Even so, no unusual or distinctive features would be lost.

In the first few years following reclamation, the new vegetation would appear similar to the premining vegetation. Over ten to twenty years, the vegetation would not be distinguishable from surrounding unmined land.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Western Energy Company would mine 42.2 million tons of coal over an eight-year period from the Area B extension; 1.8 million tons of Rosebud Coal and 14.4 million tons of McKay coal would not be recovered from the extension, owing to limitations on present technology and a lack of markets for the McKay Coal.

At an average annual coal production rate of 5.3 million tons, about 4.4 million gallons of diesel fuel and 25 million kilowatt-hours of electricity would be used at the mine each year. Total direct energy used to mine and ship the coal to Midwest markets would amount to about 7 percent of the energy equivalent of the electricity generated from the coal.

The mine would use an average of roughly 122 acre-feet of water per year. A majority of this water would be lost to evaporation and therefore would not be available for other uses downstream, such as agriculture. The population associated with the mine would require an average of about 109 acre-feet per year.

The ground water that passes through the mine spoils would, for at least several thousand years after mining, be of poorer quality than existed prior to mining. One spring, in the northwest corner of section 8, would be removed by mining. Four wells would also be removed by mining. Western Energy would install two wells to replace the four lost during mining. The company would replace the spring with a well serviced by a windmill.

The topography of the extension area would be modified during mining, but the final topography would approximate the premining contours. Over the course of several decades, the postmining landscape would begin to blend with

the surrounding countryside. The existing stratigraphy would be permanently altered; however, the stratigraphy is not unusual or intrinsically valuable.

During mining, the 1,627 acres that would be disturbed would not be available for grazing. The maximum potential loss in cattle production would total about 500 head.

Most of the twenty-three cultural resource sites and isolated finds located in the permit area would be destroyed by mining. None of these sites are significant.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY OF THE LANDS AFFECTED BY MINING

Coal from the extension of Area B would produce electricity and considerable tax revenues, royalties, and jobs. This would be achieved at a cost of short-term vegetative, wildlife, and livestock productivity at the minesite.

Over the long term, the impacts from mining would not decrease surface water quality or the value of the land for recreation, scenery, wildlife habitat, or livestock production. Ground water quality, however, would be lower.

Reductions in long-term productivity would be minimal or nonexistent. For the short-term, maximum potential vegetative productivity of the reclaimed lands would probably not be as high after mining as what could have been achieved prior to mining under optimum management. The slight reduction that could occur could last for several years, caused by unavoidable impacts on soils. Soil impacts would include disruption of natural soil profile and pore continuity, reduction of infiltration rates, and loss of structure, organic matter, and microorganism populations.

The coal produced from the extension would primarily be burned in mid-western utility plants to produce electrical energy.

Over the eight-year life of the mine, Western Energy would pay a total of about $156 million in taxes and royalties. The taxes would help finance schools, both in Rosebud County and the State, and would pay for other State, local, and Federal government expenses.

Chapter IV

DENIAL OF THE PERMIT AMENDMENT

After reviewing Western Energy's mining and reclamation plan, the Department of State Lands must take one of the five alternatives listed in the introduction: (1) approve the permit amendment as proposed, (2) take no action, (3) deny the permit amendment, (4) selectively deny the permit amendment, or (5) approve the permit amendment with stipulations.

Chapter III described the impacts of approving the permit amendment as proposed. The impacts of the second alternative, no action, would be the same as those of approving the permit as proposed. The impacts of denying the permit are described in this chapter. The impacts of the remaining two alternatives, selective denial and approval with stipulations, would fall somewhere in between approval as proposed and denial.

For the analysis in this chapter, several assumptions were made. These do not indicate Department policy or intentions; they provide a base from which to project impacts. The analysis assumes that (1) the permit amendment for the Area B extension is denied, (2) Western Energy Company does not make up for the coal lost in Area B (5.3 million tons per year for eight years), and (3) all future applications for extensions of existing mines are approved, including applications for Rosebud Mine Areas A, C, and D. The future actions of the Department are unknown. But these assumptions provide an illustration of the effects of one of the alternatives available to the Department.

Effects on the Physical Environment

Denial of the permit amendment would leave 42.2 million tons of Rosebud coal in the ground. The overburden that lies above the coal seam, as well as the landscape, surface waters, vegetation, and soils would remain undisturbed.

Mining in the part of Area B already permitted (sections 3, 4, 9, and 10) would continue to change ground water flow directions and potential ground water elevations. Denial of a permit amendment would eliminate the projected two- to threefold increase in total dissolved solids (TDS) in Area B ground water. But ground water generally flows from the west and southwest through Area B. So mining in Area C, on the south side of the East Fork of Armells Creek, would eventually (in about ten years) cause such a two- or threefold TDS increase. If both Area B extension and Area C were to be mined, the total increase in total dissolved solids would be greater than two- or threefold. Exactly how much greater is unknown, although the increase would probably not be double the increase of mining either area alone.

Total suspended particulate concentrations near the Area B permit area boundary would decrease if the permit amendment were denied. But the effects on concentrations in Colstrip would be small. Air quality would remain essentially as described in chapter II.

The destruction of wildlife habitat by mining would be temporary if reclamation is successful. Even so, the 1,627 acres of habitat now contained within the disturbance area would not be destroyed if the permit were denied. Most important, the amount of habitat for the species characteristic of upland grassland habitats would remain the same. Potential nongame bird and sharp-tailed grouse nesting and brooding habitat would not be directly disturbed. A certain amount of displacement may occur through increased activity on other proposed mine areas.

Denial of the permit would stop destruction of the cultural resource sites found within the disturbance area. Some of the sites located in the buffer zone, the one-mile band around the permit area, are significant and may be subject to damage from mining in Areas C and A.

Effects on the Social and Economic Environment

The size of the annual average work force for the Area B extension would be 156. (See table III-3.) The size of the work force for the recently permitted Area C, Block 1, is estimated at about 211. Denial of the Area B extension permit amendment would eliminate 156 jobs, or about 74 percent of future mining employment and income growth stemming from the expansion of Rosebud Mine into Area C. The reason for this is that employees from Area B would be transferred to C, eliminating 156 of the 211 new jobs.

Elimination of these jobs would have a number of effects. First, Western Energy Company's mining contractor would be forced to lay off employees. Union contracts have seniority provisions, so the most recently hired employees, (those hired to work in Area C) would be laid off first. Recent and projected future gains by Northern Cheyenne workers in mine employment would be jeopardized by any layoffs. About 75 percent of the community land use impacts expected to arise from growth of the entire Rosebud Mine work force--impacts such as land consumed for housing development--would be eliminated. The increase in traffic expected from more jobs would also be eliminated.

The population of the Colstrip area would be reduced by denial of the permit amendment. The population low projected for 1987 would be slightly lower than indicated in chapter III. Further, the population stemming from Area B employment would not exist during the 1984 to 1986 period, years of rapid population decline. As a result, the stabilizing effect on social life (expected to be provided by the population associated with Area B) would be removed.

Housing and medical services in Colstrip are projected to be inadequate through 1985. Denial of the Area B permit amendment would lessen but not eliminate the inadequacy of these services and facilities. Other services

that are now adequate or in surplus would remain as such. After 1985, following the completion of Colstrip Units 3 and 4, all services would be adequately supplied and some would have surplus capacity.

Coal mined in Area B is shipped by train to midwestern customers. Denial of an amendment for Area B would reduce train traffic on the Colstrip spur by at least 50 percent and as much as 80 percent.

CHAPTER V

Comments on the Draft EIS

-Letters to the Department

-Answers to the Public

The Department received eight letters commenting on the draft EIS. Starting on the next page, this chapter reproduces each letter in full. None have been omitted. Alongside each letter are the Department's answers.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101-1396

IN REPLY REFER TO:
ES

April 5, 1983

Mr. Dennis Hemmer, Commissioner
Montana Department of State Lands
Capitol Station
1625 Eleventh Avenue
Helena, MT 59601

RECEIVED
APR 06 1983
STATE LANDS

ATTENTION: Kit Walther

Dear Mr. Hemmer:

We have reviewed the draft Addendum Environmental Impact Statement, Western Energy Company's Rosebud Mine, Area B, Second Extension. The draft statement does not address threatened or endangered wildlife species. The Fish and Wildlife Service provided the Office of Surface Mining, Denver, Colorado, on September 8, 1982, with a list of threatened and endangered species that may be present on Area B, Rosebud Mine (copy attached). Documentation of the potential occurrence of these species in Area B and findings of a biological assessment to determine the effects of this project on listed species should be included in the final environmental impact statement.

We appreciate the opportunity to review and comment on the DEIS for this project.

Sincerely,

John G. Wood
Field Supervisor
Ecological Services

Attachment: 1

cc: Director, Montana Department of Fish, Wildlife, and Parks, Helena, MT
Regional Director, USFWS, Denver, CO (HR)
Regional Director, OSM, Denver, CO

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101-1396

IN REPLY REFER TO:

September 8, 1982

Mr. Allen D. Klein
Administrator
Western Technical Center, OSM
Brooks Towers
1020 15th Street
Denver, Colorado 80202

Dear Mr. Klein:

This responds to your August 30, 1982, memoranda regarding the proposed Dry Fork Mine, Rosebud Coal Sales Company (Surface Coal Mine), Kemmerer Mine, and Rosebud Mine, Area B, in Wyoming and Montana.

In accordance with Section 7(c) of the Endangered Species Act as amended, we have determined that the following listed and proposed threatened and endangered species may be present in the project area.

	Species Occurrence[1/]		
Project	Bald Eagle	Peregrine Falcon	Black-footed Ferret
Dry Fork Mine	a, b	a	c
Rosebud Coal Sales Company (Surface Coal Mine)	a, b	a	c
Kemmerer Mine	a, b	a	c
Rosebud Mine, Area B	a, b	a	c

Expected Occurrence[1/]

a) Migrant
b) Wintering
c) Possible resident on prairie dog colonies

Section 7(c) of the Act requires that you conduct and submit to the FWS a biological assessment to determine the effects of the proposed project on listed and proposed species. If not initiated within 90 days, the list should be verified with the FWS prior to initiation of the assessment. The biological assessment should be completed within 180 days of initiation, but can be extended by mutual agreement between your agency and the FWS. The assessment conducted pursuant to Section 7(c) may be undertaken as part of your agency's compliance with the requirements of Section 102 of NEPA and incorporated into the draft EIS.

Our information to date on the three species you mention follows:

Bald Eagle. Bald eagle use of the proposed permit area is minimal. In 11 years, only 7 bald eagles were observed within about 10 miles of Colstrip. Eagles have been sighted during autumn, winter, and spring. Five of these birds were believed to be unpaired; data does not indicate if the remaining two were paired or unpaired. The nearest known nesting area is 35 miles north of Colstrip (Ecological Consulting Service, 1972-80, Western Energy Company, 1980-82). Mining operations would not significantly affect bald eagles.

Peregrine Falcon. Eleven years of observation data reveal no peregrine falcons in the proposed permit area or within about 10 miles of Colstrip (Ecological Consulting Service, 1972-80, Western Energy Company, 1980-82).

Black-footed Ferrets. The closest prairie dog colony is along Stocker Creek, over 4 miles from the proposed permit area. No black-footed ferrets or their sign have been observed in this colony (Ecological Consulting Service, 1976 and 1980).

Upon completion of your assessment, if you determine that the project will affect any of the above listed species, formal consultation with the FWS through my office should be initiated. If you determine that any proposed species may be affected, an informal conference with my Endangered Species Team should be initiated to discuss measures that can be taken for their conservation. Section 7(d) of the Act requires that during the consultation process, the Federal agency and the permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives.

Please contact us if we can be of further assistance.

Sincerely,

Wayne G. Brewster
Field Supervisor
ENDANGERED SPECIES

cc: ES Field Supervisor, Billings
ES Field Supervisor, Cheyenne

NORTHERN PLAINS RESOURCE COUNCIL

Field Office
Box 858
Helena, MT 59624
(406) 443-4965

Main Office
419 Stapleton Building
Billings, MT 59101
(406) 248-1154

Field Office
Box 886
Glendive, MT 59330
(406) 365-2525

Mr. Kit Walther
EIS Team Leader
Montana Department of
State Lands
Capital Station
Helena, Montana 59624

APR 7 1983

April 6, 1983

RE: Comments on the Draft Environmental Impact Statement, Area B Extension, Rosebud Mine.

We appreciate the opportunity to briefly comment on Western Energy Company's Rosebud Mine, Area B Second extension. We would like to compliment the EIS team on one of the more readable and well edited EIS's that we have seen. The approach and format were excellent.

There are two major concerns that should be noted prior to commenting on specific aspects of the DEIS.

A Several months ago, WECo submitted a proposal to the Montana Department of State Lands (DSL) to "dewater" Area B prior to commencement of mining. According to WECo, they needed to dewater prior to receiving a permit for safety reasons and to insure maximum coal recovery. At the time of that application there were serious questions raised, not only on the legality of the request, but on the impact that dewatering and subsequent release of water into the East Fork of Armells would have.

It was not clear from reviewing the DEIS whether WECo's plans to dewater were the same as the earlier proposal. The DEIS doesn't address during which months of the year the dewatering would take place, or what subsequent facilities would have to be built, such as holding ponds for the water pumped from the overburden and the alluvium.

Without this information it is impossible to make an accurate assessment of whether WECo has affirmatively demonstrated that the hydrologic balance of East Fork Armells Creek won't be adversely affected. It is also difficult to assess whether the dewatering proposal has been designed to prevent material damage to the East Fork of Armells Creek. (82-4-227(3)(a))

A To clarify this matter, we have added to the final EIS a discussion of Western Energy Company's dewatering plan, which the Department has so far not approved. The dewatering plan is not part of the extension permit application. Text has also been added regarding the consequences of pit water discharges.

p. 2. NPRC comments on Area B Second Extension

Cumulative Hydrologic Impact

B The reference to the Area C, Block 1 EIS for cumulative hydrologic assessment is totally inadequate.

The Area C, Block 1 EIS did not fully address the cumulative hydrologic impacts associated with the Rosebud complex. In response to NPRC comments on the Area C, Block 1 DEIS, DSL noted that the "Comprehensive FIS, not the Area C EIS will serve as the reference document for future EIS's for the Rosebud Mine. (AREA C, Block 1, FEIS p. VIII-8) The Area C DEIS states that the "comprehensive EIS will address the cumulative impacts of all the proposed mining.....and industrial activities in the area". However, the Comprehensive, which is not referenced as it should be, does not address all the cumulative hydrologic impacts of the Area. It does not include the stress on the existing hydrologic balance that will result from the proposed fly ash pond leaking.

The point is, the Area B extension refers to the Area C EIS in regard to cumulative hydrologic impacts. The Area C EIS refers to the Comprehensive for further support and additional information to be used for a cumulative hydrologic assessment. But, the Comprehensive EIS has not been finalized, cannot be considered an adequate document until it analyizes all hydrologic impacts associated with the Rosebud complex. The Montana Department of State Lands cannot grant a permit for Area B Second Extension until a complete hydrologic assessment for mining and associated facilities has been prepared.

B References to the Area C, Block 1, EIS have been changed to the Final Comprehensive Environmental Impact Study, Western Energy Company's Rosebud Mine. An expanded and reorganized section discussing the cumulative hydrologic effects of development at Colstrip was put into the final study. A section discussing the cumulative hydrologic effects of mining Area B has also been added to chapter III of this addendum.

Quality of Coal

C A growing concern to buyers of Western low sulfur coal, and in particular Northern Powder River Coal, is the percentage of sodium present in the coal. While it may not be a significant problem at the Rosebud Mine, it apparently is elsewhere in Montana, for example Spring Creek. Will DSL include sodium content in future "quality of coal" assessments?

C Rule 26.4.322 (2)(a)(iv) requires "an analysis and summary of the chemical properties of all coal seams encountered including the content of sulfur, trace mineral elements, moisture, and ash as well as the British thermal unit (B.T.U.) content per pound" (emphasis added). One of the trace minerals routinely included is sodium.

Mining Plans

D The DEIS (p. I-9) states that WECo does not plan on building any new facilities for the Area B second Extension. Does this mean that they will not be constructing holding ponds? What measures are being proposed by WECo to insure that the pumping of water into Armells Creek doesn't create an erosion problem?

D Facilities, as used in this section, refers to permanent structures, such as buildings and powerlines. Construction of sedimentation ponds in Area B is discussed in two sections in chapter III: (1) Surface Water--Changes During Mining and (2) Surface Water--Changes After Reclamation.

Water Quality and Livestock

E It is not clear what standards DSL finds acceptable for mining related water degradation as it applies to TDS levels and livestock. In the DEIS there are two statements that seem to be contradictory. On p. II-10 it mentions that "cattle and horses can safely drink water containing TDS levels up to 6,400 mg/l" but then notes that "cattle can tolerate water containing TDS up to 7,000.....10,000 mg/l TDS". (p. III-7 DEIS) Which is correct? How does DSL define "safely drink" and "can tolerate", and what is the difference between the two?

E Both original statements were correct, although confusing. The text has been rewritten to clarify the statement in chapter II. "Safely drink" means livestock appear to suffer no ill effects up to that level. The "can tolerate" has been changed to "safely drink."

p. 3. NPRC comments on Area B Second Extension

General concerns with hydrology

F The DEIS states that the "high TDS levels in the Alluviul ground water and surface water of Cow Creek, are mainly a result of natural causes" (p. II-18). Which studies are these conclusions drawn from? Doesn't this conflict with the earlier conclusion in this same EIS that mining has been responsible for causing the rise in TDS levels? If the concentrations of TDS are due to natural causes, why don't the other ephemeral streams in the Colstrip area have such a high concentration of TDS?

G It is noted on p. III-7, that WECo's Area B application stated that "wells would be replaced with sources producing an equal quantity and quality of water". DSL then admits that this may be difficult to do because that kind of water may not be available. What will DSL stipulate to resolve this dilema? A point should be made here. In various EIS's prepared on the Rosebud complex, reference is made to the "committment of WECo has made to replace wells and springs", inferring that agricultural people have nothing to worry about. While not questioning the "committment" of Western Energy, we are concerned that what seems to lightly said, "wells will be replaced", may often be difficult or impossible to do.

H On p. 1II-8, the DEIS points out that due to spoil orientation, more water could be directed towards Cow Creek. Was this increase in flow included in the calculations that were used to come up with anticipated increases in the TDS levels in Cow Creek? Does this increase flow alter the prediction that impacts from mining won't be noticed for "1,000" years?

I A further explanation of the phenomenon of "super-saturation" would be helpful.

J Certain values and calculations are used to determine the rate of groundwater flow through various strata, including spoils. At a recent meeting with Montana Power Co., DNRC, and NPRC, Max Botz(Hydrometrics) indicated that they had noticed suprisingly high transmissivity along the Cow Creek alluvium. Has this higher transmissivity been included in DSL calculations?

Air Quality

K Is Colstrip now in compliance with annual and 24 hr TSP standards as proposed in the State Implementation Plan submitted to the Environmental Protection Agency? Also, several years ago, WECo developed a mine-wide, "dust suppression" plan. Are the dust mitigation measures proposed in that plan being extended to Area B and future permits? Finally, has DSL received an analysis of the effectiveness of this plan from the Air Quality Bureau, Montana Department of Health and Environmental Sciences?

F Mioing may be responsible for elevated TDS levels in the small tributary drainage of Cow Creek adjacent to the mine. (See MDSL and OSM 1983b, chapter 11I, Hydrology, Section 3.2.3 Cumulative Hydrologic Impacts.) But the high TDS levels in the surface and alluvial ground water for most of Cow Creek are a result of natural causes and probably to some extent due to agricultural activities upstream. (See revised text, chapter II, Man-Induced Chaoges in Surface and Shallow Ground Water.) Small ephemeral creeks in this region probably have similar water quality (Renick, 1929), although few have been sampled in as much detail as Cow Creek. See also letter 4, answer M.

G The EIS cannot say what stipulations would be imposed, since stipulations are added only to the permit, which can be issued only after publication of the EIS. In any event, although the quality of ground water feeding the spring in section 8 would he difficult to find elsewhere, water of drinking-water quality and quantity may be available as long as downward leakage from mine spoils does oot contaminate the sub-McKay aquifers. If leakage were to occur, domestic water supplies would indeed be difficult to obtain. But since the primary postmining land use for the Area B extension would probably be the raising of livestock, the sub-McKay water, or for that matter the spoils water, would be adequate stock watering sources. See revised text, chapter II, Hydrology, Ground Water, Water-Bearing Strata of Area B Extension, Other Water-Bearing Strata, and chapter III, Hydrology, Ground Water--Changes in Area B after Reclamation.

H From premining potentiometric maps, it appears that a ground water divide exists within Area E. Therefore, it is likely that Area B extension mine spoil water would move toward East Fork Armells Creek and not Cow Creek. The original statement you refer to has been deleted. See also letter 4, answer O.

I See reworded discussion regarding limits on constituents in chapter 111, Cumulative Hydrologic Effects of Mining Area B (7, 8, 17, 18).

J Yes. The higher than expected transmissivities along the middle reach of Cow Creek indicate flows of roughly 120 to 180 gpm, about three times the flow in the alluvium of the East Fork of Armells Creek near Area B. An expanded discussion of impacts is contained in the Rosebud Mine Comprehensive Environmental Impact Study (MDSL and OSM, 1983b, chapter III, Hydrology, section 3.2.3). Because very little, if any, Area B spoils water would flow toward Cow Creek, the discussion regarding effects on Cow Creek is no longer contained in the EIS.

K Compliance with the ambient standards for the Colstrip area is based on the Montana Power No. 3 sampler located in the town of Colstrip. This sampler was relocated about a year ago. The data obtained thus far indicate compliance with the standards; however, twelve months of monitoring data is required to make a determination, and a full year of data is not yet available. The Department of State Lands will receive a copy of the monitoring data and official compliance decision.

Western Energy's mine-wide dust suppression mitigation measures do apply to Area B and other areas of the Rosebud Mine. Current mine permit applications indicate that the mine-wide measures have effectively reduced TSP concentrations. Future permit applications would be required as Western Energy proposes to mine in new areas. In the applications, Western Energy would analyze its dust control program for that area. The best available dust control technology would be used (BACT).

p. 4. NPRC comments on Area B Second Extension

L In closing we repeat, a cumulative hydrologic assessment for the Rosebud complex has not been completed. Until such an assessment is done, the Area B, or any other permit, cannot be granted. Further, until all mining and industrial activities are included in the Comprehensive EIS, it will not serve as a cumulative hydrologic assessment as mandated by law.

We again thank you for the opportunity to comment on the Area B Second Extension Draft EIS.

Sincerely,

Russ Brown

Russ Brown
NPRC Staff

L A reorganized and updated cumulative hydrologic impact discussion on Area B has been added to this addendum. The cumulative impacts for the whole Rosebud Mine has been added to the Comprehensive Environmental Impact Study (MDSL and OSM, 1983b, section 3.2.3).

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
ENVIRONMENTAL SCIENCES DIVISION

TED SCHWINDEN GOVERNOR
COGSWELL BUILDING
STATE OF MONTANA
(406/449-3946
HELENA MONTANA 59620

April 6, 1983

Kit Walther
EIS Team Leader
Dept. of State Lands
Capitol Station
Helena, MT 59601

APR 1 1 1983

Dear Kit:

The Department of Health and Environmental Sciences (DHES) has reviewed the environmental health aspects for the draft addendum environmental impact statement (EIS) for Western Energy Company's Rosebud Mine - Area B, Second Extension and the draft comprehensive EIS for Western Energy Company's Rosebud Mine. The DHES staff did not have any comments.

Thank you for the opportunity to review the impact statements.

Sincerely,

Tom

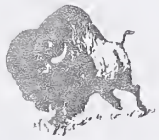
Thomas M. Ellerhoff
Technical Writer

jg

AN EQUAL OPPORTUNITY EMPLOYER

Thank you for reviewing the document.

WESTERN ENERGY COMPANY
115 N. BROADWAY / P.O. BOX 1899 / BILLINGS, MT. 59101 / (406) 252-2277



April 11, 1983

Mr. Kit Walther
EIS Team Leader
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

APR 13 1983

Re: Comments on Area B, Draft EIS

Dear Kit:

Attached are Western Energy Company's comments on the Draft Environmental Impact Statement Area B, Sections 7, 8, 17, and 18.

Cordially,

Chris Cull
Manager,
Operational Permitting

CC:kim

LETTER 4

WESTERN ENERGY COMPANY
Comments: Area B: 7, 8, 17, 18
Draft Environmental Impact Statement

A Page I-1: Western Energy has 1,794.4 acres currently permitted in Area B, not 2,542 acres.

246 acres would be bonded for Associated Disturbance not Factilities Disturbance.

B Page I-12: Western Energy does not plan to haul boxcut spoils to the final pit.

C Page II-2: Two overburden holes (N42,E42 and N43,E47) were redrilled. Each five foot increment was analyzed for determination of zinc. No concentrations greater than 4 ppm were found which indicates that drill stem lubricant contamination was the cause for abnormally high levels reported in the permit application.

D Page II-15: The Department of State Lands determined on December 10, 1981, that for the portion of East Fork Armells Creek (EFAC) between the western extent of Western Energy Company's Area C and Highway #39 near the town of Colstrip, Montana, that it is the decision of the Department that an alluvial valley floor does not exist along this portion of EFAC.

E Page II-21: The phrase "In the Rosebud Mine area, these soils consistently support vigorous stands of ponderosa pine and Rocky Mountain juniper" should be changed to "In the Rosebud Mine area, these soils commonly support stands of ponderosa pine and Rocky Mountain juniper.

F Page IV-3: As discussed in the previous section on Social and Economic Environment, there is no mention of the $156 million loss in taxes and royalties if the permit amendment is denied.

Specific hydrology comments follow:

G The summary section states "Mine spoil from Area E and old Northern Pacific spoil has and will continue to change the water quality in Cow Creek, possibly decreasing the productivity of creek-bottom vegetation near the mine. Spoil water from Area B and Area B extension may reach Cow Creek within 1,000 years, but possibly not before 10,000 to 20,000 years, continuing increased TDS levels..." The first sentence is not a statement of fact, but is pure conjecture. Most Area B spoil water will flow to East Fork Armells Creek and will not affect Cow Creek as shown on Exhibit G-1a of Western Energy's response to item

A Thank you for correcting us. The text has been revised.

B The text has been revised.

C Thank you for the information. Note text change.

D The text has been changed per your comment.

E The Department agrees with your statement. Note text change.

F The taxes and royalties would not necessarily be lost if the permit amendment were denied. If the production shifted to some other mine in Montana, the revenues would still be received. The amount could well be different, because tax payments would depend on whose coal was being mined and the mining costs of the operation. You are right, however, that if the production were not shifted to some other mine in Montana the revenues, of course, would be lost.

G The hydrology summary has been rewritten. We agree that Area B spoils water would not move directly to Cow Creek. But indirectly, through slight but persistent downward movement of ground water throughout the Rosebud Mine, spoil water would eventually reach the creek. (See also chapter III, Cumulative Hydrologic Effects of Mining Area B (sections 7, 8, 17, 18).

In regard to pit pumpage, Western Energy Company states the following on page 184 of the Area B extension permit application: "From any of these temporary containment areas, water could be pumped to authorized water discharge points, where water would be discharged in accordance with MPDES discharge permits." With high initial pit inflows, Western Energy probably would have to discharge large amounts of water to the East Fork of Armells Creek once the temporary detention ponds are filled.

2.b) on page 3 of DSL's deficiency letter of February 3, 1983. It is further stated in the summary that pumping water out of the mine area would add a considerable amount of groundwater to the East Fork of Armells Creek. Western Energy did not discharge water to East Fork Armells Creek when the pit in Section 4 (in a similar hydrologic setting) was opened and does not anticipate having to discharge water as a result of opening the boxcut in Section 7, 8, 17, & 18.

H The range of spoil water quality in Table II-3 on page II-7 is incorrectly given as 1,044-10,619 with an average of 3,298. The correct values are 1,044-6,710 with a mean of 2,902.

I Figure II-1 which is labeled "Regional Groundwater Levels (potentiometric surface) of the Rosebud Coal Aquifer" is not a potentiometric surface map. The elevations shown bear little relation to measured water level elevations, but were derived by means of a process called "kriging" which is essentially a trend analysis of the data.

J Flow directions shown on Figure II-2 on page II-9 are not correct for the Rosebud coal. Figure II-5 shows the correct configuration of the potentiometric surface for the Rosebud Coal based on actual measurements.

K On page II-10 it is stated "Mining has modified groundwater flow directions up to a mile from the mine. Near active mine areas, Rosebud Coal and Rosebud overburden groundwater flows into open pits, lowering groundwater elevations (potentiometric levels) around the mine. The greatest drawdown occurs adjacent to pits, reaching 80 feet next to Area B (MDSL and OSM, 1982, Figure 3.2-5)". These statements are apparently based on ERTEC's model which predicted modified flow directions up to a mile from the pits and predicts drawdowns from up to 80 feet for Area B in the year 1995 (MDSL and OSM, 1982, Figure 3.2-5). At this time drawdown has been measured up to 0.4 miles from the pit in Area A.

H Thank you for pointing this out. The text has been changed.

I Figure 1 has been replaced, for the reasons you mention, with a better interpretation of the potentiometric surface of the Rosebud coal.

J Figure II-2 has been replaced with a figure showing the correct flow directions.

K Dollhopf et al. reported (1979) drawdown in an observation well located over ½ mile west (upgradient) of Area B (well 41R) and Van Voast et al. (1977) reported no detectable drawdown at wells located 1½ miles east of the Big Sky Mine (wells BS-5 and BS-6). We have changed the text to indicate these findings.

L On page II-10 it is also stated that "mine pits also cause drawdowns in reclaimed spoil (See Figure II-3)". Western Energy does not understand how drawdowns can occur in material that is still being resaturated after initially being essentially dry.

M It is further stated on page II-10 "Alluvial groundwater in the head waters of Cow Creek next to Area E has elevated TDS values. A recorded 5 to 25 percent increase from roughly 4,000 mg/l to 5,000 mg/l probably stems from Area E spoil water seepage (MDSL and OSM, 1982, Section 3.2.1.1.2, Valley Fill). The Section refered to on page 3-18 (MDSL and OSM, 1983, Section 3.2.1.1.2, Valley Fill) states "...measured TDS values for wells WA-144 and WA-145 (located just upstream of Well WA-135, Figure 2.2.-13) are estimated to be from 5% up to 25% higher than if mining had not occurred" (emphasis added). To take "estimated" impacts and quote them as "recorded" increases is misleading. Water quality data tabulated below suggest that Cow Creek alluvial groundwater may be typical of water from similar sized headwater areas in unmined areas. Upper Cow Creek alluvial groundwater is actually of better quality than uppper Stocker Creek alluvial groundwater.

Upper Cow Creek		Upper Stocker Creek	
Well	TDS	Well	TDS
559A	2820	WA-166	3943
558A	2770	WA-165	3064
557A	2540	WA-164	2442
WA-132	2685	WA-167	2137
WA-133	3690	WA-168	3244
WA-135	4181	WA-169	4922
WA-142	4776	WA-170	4081
WA-144	5070	WA-110	2290
WA-145	4805	WA-111	2807
WA-134	2447	PW-107	6640
WA-138	DRY	PW-53	1589
AVERAGE	3578	AVERAGE	3716

L The ground water levels in reclaimed spoils are lower than they would be if mine pit drawdown influences from adjacent mine areas were not limiting recovery. The wording of this sentence has been changed to clarify this point.

M The original wording of this sentence was poor and has been changed to indicate that the 5 to 25 percent increase is an estimate and not based upon recorded data. Thank you for pointing out this error.

The data in your letter suggest that grain fields lying upgradient have degraded the alluvial ground water quality of many of the alluvial wells Western Energy lists for Stocker Creek. Specifically, wells WA-164, WA-165, WA-166, WA-169, WA-170, WA-110, WA-111, and PW-107 (average TDS = 3,700 mg/l) located in Stocker Creek have 60 percent higher TDS levels than wells WA-167, WA-168, and PW-53 (average TDS = 2,300 mg/l), which do not lie downgradient of hay and grain fields. In Cow Creek, TDS levels in WA-135, WA-142, WA-144, and WA-145, all in the same small tributary, averaged 4,700 mg/l TDS. These four wells, in contrast to those along Stocker Creek, lie just downgradient of old Northern Pacific mine spoil and standing water ponds located in mine spoil. The TDS levels in these wells have 60 to 70 percent higher TDS than the remainder of the alluvial wells listed by Western Energy (average TDS = 2,800 mg/l). An additional well (S-05) located immediately downgradient of additional old Northern Pacific spoil in the South Fork of Cow Creek averaged 5,300 mg/l TDS.

The data indicate that mine spoil has contributed to higher TDS values. Because Northern Pacific spoil was left unreclaimed for decades, water in the past probably collected between and seeped into spoil ridges. We believe, although cannot conclusively prove, that some of the spoil water naturally flowed toward Cow Creek. In the parts of Cow Creek near the mine, where alluvial ground water flows are small, Northern Pacific spoil water probably increased Cow Creek alluvial ground water TDS levels. Further downstream, where flow is far greater, mine spoil has had less influence because of dilution in the alluvial system.

N Figure 3 on page II-11 (reproduced from Figure II-. on page II-12 of the final EIS for(Area C Block I) is in direct conflict with Figures II-6 and II-7 of the final EIS for Area C Block I. These last two figures demonstrate that water levels in the alluvium are higher than water levels in the spoils, and that flow is from the alluvium to the spoils.

O The sixth paragraph on page II-12 states "Most of the total flow in the Rosebud seam (1 to 3 gpm) flows to the East Fork of Armells Creek alluvium or moves east toward the Cow Creek drainage". No Area B spoils water is likely to reach Cow Creek, as shown on Exhibit G-1a in Western Energy Company's response to item 2.b on page 3 of the Departments deficiency letter dated February 3, 1983.

P Figure II-5 on page II-14 which correctly shows the potentiometric surface of the Rosebud Coal seam in Area B does not resemble Figure II-1 at all. This discrepancy should be explained. It should also be explained why the potentiometric contours extend across the areas where the Rosebud Coal does not exist.

Q The third paragraph on page II-15 ignores the presence of Wells WD-159 and WD-160.

R In the fourth paragraph on page II-16 it is stated "In the Rosebud Mine area groundwater in the Rosebud Coal seam, the McKay seam, and the SubMcKay primarily flows toward the small ephemeral tributaries of Rosebud Creek, mostly to Cow Creek (See Figure II-2)". Figure II-5 on page II-14 which is a correct representation of the potentiometric surface for the Rosebud Coal (although flow directions don't agree well with the contours) shows flow toward East Fork Armells Creek. Only groundwater flowing through the McKay Coal and Sub-McKay sands, both of which will not be significantly (if at all) affected by mining, will reach Cow Creek.

S At the bottom of page II-16 and the top of page II-17 it is stated "The spring normally flows into the ephermal drainage but stopped in December, 1981 due either to a lack of precipitation or groundwater drawdown from the Area B

N Although flow is from the alluvium to the spoils in Area B (section 3), in Area A the opposite is true. The flow from Area A to the alluvium probably stems from the opening of mine pits in Area B and decreased precipitation since mid-1979, which together have lowered alluvial ground water levels adjacent to Area A. (See ground water hydrographs of wells P-01, P-02, P-03, P-04, P-05, WA-115, WA-129 (recovery), WA-125, WA-126, WA-127, EX-024, EX-001, EX-027, and WA-131.) Meanwhile, spoil wells WS-115, WS-106, WS-107 in the upper part of Area A have been well above the alluvial levels. Similarly, spoil wells EX-200, EX-202, EX-203, EX-204, and EX-205 in Area A have been at or slightly above adjacent alluvial ground water levels. Spoils water consequently has entered the alluvium of East Fork Armells Creek, raising TDS levels about 70 percent in adjacent alluvial wells (PO-4 and PO-5). The spoils seepage has, in addition, added to industrial waste water seepage, significantly increasing TDS concentrations in downstream wells (WA-149, WA-150, WA-151, WA-152, P-11, and P-12). The average predevelopment TDS concentration was about 2,500 to 3,000 mg/l, whereas after mid-1979 the average concentration was above 4,600 mg/l.

O Although Area B extension mine spoil water would not reach the Cow Creek drainage directly, because of a near-surface ground water divide in Area E, the gradual but persistent downward migration of ground water near Colstrip would force spoil water into lower water-bearing strata, which in turn could influence Cow Creek water quality. (See revised chapter III, Cumulative section and Western Energy's Area B (7, 8, 17, 18) permit application Exhibit G-4.)

P Figure II-5 has been corrected and now agrees with figure II-1.

Q This paragraph has been revised. Much sub-McKay water quality data was unavailable at the time of preparation of the draft EIS and therefore was not included.

R See answer G. Some spoils water would move downward into the Rosebud-McKay interburden, McKay coal, and possibly the sub-McKay. Evidence of downward movement comes from pond seepage around the industrial ponds at Colstrip and premining potentiometric levels. Overall ground water movement in these water-bearing strata is toward the Cow Creek drainage. (See revised chapter III, Hydrology, Cumulative Effects of Mining Area B (7, 8, 17, 18.) In fact, these lower units may be more a conduit for spoils water than the Rosebud coal itself.

S We are not sure which wells between the active mine pit and the spring Western Energy believes have not declined. Well WR-101, completed in the Rosebud coal seam and about the same distance from the pit as the spring, dropped over 10 feet from May 1979 to December 1981. Similar water level declines in the overburden feeding the spring are likely. The spring is within one-half mile of the active mine pit in Area B (4, 9 and 10). Mining cannot be ruled out as a probable contributor to loss of this spring. In fact, precipitation near Colstrip dropped appreciably in mid-1979, yet the spring did not dry up until December 1981 when the drawdown effects of expanded mining into Area B, section 4, would have reached the spring. Peter Norbeck is now cited only in reference to when the spring dried up.

pit (Peter Norbeck, Western Energy Company, oral communication, August, 1982)". Peter Norbeck in a oral communication in August of 1982, attributed the water level decline near the spring in Section 8 to climatic fluctuations. This is based on the fact that water levels between the pit and the spring had remained stable while water levels at the spring had dropped as much as three feet. If the lower water levels at the spring were caused by the pit, the greatest declines would have occurred nearest the pit. Therefore, the cause of the water levels declines around the spring is not due to mining.

T The last sentence on page II-17 states "Three wells adjacent to or under Area E and Northern Pacific's mine spoil have elevated TDS levels and show a trend toward increasing salinity over time (MDSL and OSM, 1982 b, page II-42)". DSL has again chosen to ignore facts and to misinterpret the data from Wells S-04, S-08 and WM-127. As Western Energy has repeatedly demonstrated to the Department of State Lands, the poor water quality in Well S-04 (TDS levels have been decreasing since August of 1979) cannot be related to the water quality of either the spoils or McKay up-gradient from that well. See also Western Energy's response to Stipulation 4a (SMP 81003E). Water quality for wells up-gradient from S-04 in both the McKay and the spoils are tabulated below.

McKay		Spoils	
Well	TDS (mg/l)	Well	TDS (mg/l)
S-03	1348	S-01	2782
S-29	885	S-02	2136
WM-121	305	EPA-3	1157
WM-122	457	EPA-6	4307
WM-123	480	EPA-10	2225
		EPA-12	1096
AVERAGE	695	WS-110	1792
		WS-112	2395
		AVERAGE	2236

T TDS levels in well S-08 are triple the levels in McKay wells upgradient and downgradient. WM-127 may, in fact, be affected by drilling fluids, since the calculated Rosebud well (WR-129) also has very high TDS levels. We are not sure why well S-04 is so high. This paragraph has been rewritten per your comment.

Water quality in Well WM-127 is a result of drilling additives used to hold the hole open in drilling through scoria. Water quality of Well S-08 is within the range of water quality found in McKay wells up-gradient from mining.

U On page III-4 and III-5, it is stated "Mine spoil from Area E and old Northern Pacific spoil has and will continue to change the water quality in Cow Creek, possibly decreasing the productivity of the creek bottom vegetation near the mine. Spoils water from Area B and Area B Extension may reach Cow Creek within 1,000 years, but possibly not before 10,000 to 20,000 years continuing increased TDS levels and impacts on creek bottom vegetation". The first sentence is not a statement of fact, but is pure conjecture. Most groundwater from Area B spoils will flow toward East Fork Armells Creek as shown on Exhibit G-1a in Western Energy Company's reponse to item 2b on page 3 of DSL's deficiency letter of February 3, 1983.

U The summary section has been rewritten. See also answers G and M.

V Paragraph two on page III-5 states "...pumping water out of the mine area would add a considerable amount of groundwater to the East Fork of Armell's Creek". Western Energy does not anticipate having to pump groundwater to East Fork Armells Creek except in connection with the dewatering plan. As stated in that plan, only water pumped from the alluvium would be discharged to East Fork Armells Creek where it would recharge the alluvium. The net change in flow in the alluvium would be a slight decrease because water from the over-burden would no longer reach the alluvium.

V Western Energy's dewatering plan has not been accepted as part of the Area B extension permit application. See answer G and letter 2, answer A.

W The third paragraph on page III-5 addresses flow in East Fork Armells Creek, Pony Creek, Cow Creek, South Fork Cow Creek, Hay Coulee, Coal Bank Coulee, Miller Coulee or Lee Coulee. Western Energy is completely mystified by the predicted decrease in the flows of Stocker Creek, Pony Creek and in Cow Creek. It is extremely unlikely that mining in the Area B Extension could affect the flow of Cow Creek as demonstrated by Exhibit G-1a in Western Energy's

W This paragraph was intended to point out changes caused by the entire Rosebud Mine and not just Area B. The paragraph has been reworded and moved to Cumulative Hydrologic Effects.

reponse to item 2c on page 3 of DSL's deficiency letter of February 3, 1983. Any effects on the stream flow of Pony Creek and Stocker caused by mining in Area B are totally beyond the realm of possibility.

X In the fourth paragraph on page III-5, the effects on groundwater levels adjacent to mines is again addressed. See comments to similar statements on page II-10.

Y On page III-8 in paragraph 6, impacts of the Rosebud Mine on the Big Sky Mine are addressed. These impacts have been assessed in Western Energy's reponse to item 2 on page three of the Department's deficiency letter dated February 3, 1983.

Z On page III-11, fourth paragraph, the statement is made "Mining would eventually affect the surface waters of Cow Creek". In Western Energy's response to item 2b, it is demonstrated that mining in Area B will not be likely to affect Cow Creek. In that same paragraph it is stated "Three McKay Coal seam wells located along the eastern (down-gradient) side of Area E have TDS levels well above the average for the McKay coal seam elsewhere around Colstrip (Wells S-04, S-08, WM-127). Seepage of mine spoil water into the McKay coal seam appears to be the most reasonable explanation for the elevated TDS levels". Seepage of spoil water cannot possibly be the source of poor quality water in Well S-04 as shown in Western Energy's comments to statements on page III-11. See also Western Energy's response to stipulation 4a (SMP 8003E). As has been repeatedly explained to the Department WM-127 was affected by drilling additives used to keep the hole open while drilling through scoria. Well S-08 is within the range of McKay water quality for McKay wells up-gradient of mining.

AA On page III-12 it is stated "Selective placement techniques using draglines have been successfully demonstrated in Area B, but the techniques did increase

X See answer K.

Y Western Energy's response to the Department's deficiency letter dated February 3, 1983, was received after this section was written. Western Energy's new information has been incorporated into Cumulative Hydrologic Effects.

Z This paragraph has been rewritten and included in Cumulative Hydrologic Effects (chapter III). See also answers G and T.

AA Dollhopf, et al. (1981) found that operating costs increased by 11 percent for selective placement of saline overburden and 58 percent for selective placement and capping of the saline material with a clay layer. They found that very little vertical recharge occurred in Area B and therefore capping the saline overburden with clay was unnecessary. Therefore we reported only the lower, 12 percent figure in the EIS.

R.L. Houghton's report discusses mining techniques different from those used at the Rosebud Mine. Applying Houghton's suggestions would be difficult in Area B.

operating costs by about 10% (Dollhopf et al, 1981)". Dollhopf estimated a 12 to 53% increase (Dollhopf, et al., pp. 89-90) over "normal operations" which were in fact operations specified by him and which were not normal for the Rosebud Mine. A better assessment of cost of selective placement might be a statement by R.L. Houghton of the U.S. Geological Survey during a presentation of a paper at the 1982 Symposium on Surface Mining Hydrology, Sedimentology, and Reclamation when he suggested that regulators not consider selective placement because the technique increase costs by more than 30%.

BB On page III-12 mitigating measures for water logging of hay fields downstream from Colstrip are suggested. A better mitigating technique might be to simply install discharge structures on the spreader dikes as should probably have been done in the beginning.

BB Your suggestion has been added to the Final Comprehensive Environmental Impact Study (DSL and OSM, 1983b, chapter III, Hydrology, Mitigating Measures).

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Miles City District Office
P.O. Box 940
Miles City, Montana 59301

IN REPLY REFER TO: 3500

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APR 1 0 1983
STATE LANDS

APR 12 1983

Gary Amestoy, Administrator
Reclamation Division
Montana Department of State Lands
Capitol Station, 1625 11th Avenue
Helena, Montana 59620

Dear Mr. Amestoy:

In response to your March 14, 1983 request for comments on the Draft Environmental Impact Statement for Western Energy Company's proposed extension of Area B, we are submitting these remarks on hydrology and air quality.

Hydrology:

A This document describes overburden groundwater quality in Section 8 as being very good and somewhat rare in eastern Montana. Mining would deteriorate the water quality so that it would most likely be unsuitable for domestic purposes. The sub-McKay aquifer is being proposed as a post-mining replacement source of water. Only one value for total dissolved solids (TDS) concentration has been provided for the sub-McKay in Section 8 and it appears to be more of an anomaly than the usual case for this aquifer. If the lowest TDS concentration for overburden water is compared to this one value for the sub-McKay, the difference between water quality available now and what could be available in the future is quite large. Since McKay-coal water appears to be deteriorating due to nearby mining it seems quite possible sub-McKay water quality could be degraded as well, shedding further doubt that water could be obtained following mining with quality equal to that currently available. To say that water of such good quality will probably not be needed in this area does not seem to be a viable reason for dismissing that inability to protect the current hydrologic balance.

With respect to the statement that no overburden wells used for domestic or agricultural purposes lie within 1½ miles of the proposed permit area, a question is raised as to whether there are overburden wells down gradient and outside of this distance with water quality that could be affected adversely by mining.

Air Quality:

B The document states: that (1) the state implementation plan (SIP) intends to bring Colstrip into compliance with annual and 24-hour TSP standards by

A We agree with your comments on the sub-McKay aquifer. But we believe that since Yellowstone River water is available for residences at Colstrip and since community development will be confined primary to the town itself, the replacement of overburden water with sub-McKay water would not likely preclude the primary future water use--livestock watering. Another possible source of water other than the sub-Mckay would be the same good quality overburden water upgradient of the mine, providing that sufficient quantities are available.

No overburden wells other than Western Energy Company's observation wells would be affected by mining the Area B extension. Overburden waters appear to flow primarily from the uplands separating the East Fork Armells Creek and Miller Coulee (southern part of Area B) toward the East Fork of Armells Creek. As such, mining of Area B would not affect areas farther up or downstream of the mine along the East Fork of Armells Creek.

B Please see letter 2, answer K.

December 31, 1982; and (2) that although Western Energy has undertaken a number of dust control measures in recent years, the measures have not significantly reduced TSP concentrations in Colstrip. Since this document was published in March of 1983, it appears that the SIP objectives have not been met. If this is the case, should a new permit be granted in light of the fact that no extensions for TSP are allowed?

If you would like to discuss these subjects further, please feel free to contact Les Dobson of our office, phone number (406) 232-4331.

Sincerely yours,

R. W. Hunt

District Manager
ACTING

LETTER 6

Rte 1 Box 24
Forsyth, Montana

Mr. Kit Walther
EIS Team Leader
Dept. of State Lands
Capital Station
Helena, Montana 59620

Re: Addendum EIS--WECo.
Area B--2nd Extension

Dear Mr. Walther:

Thank you for the opportunity to comment on the above named EIS.

A Of the sixteen subjects of this EIS, one must not be studied from a site specific viewpoint, namely HYDROLOGY. As you must be aware, water flows, moves, both on surface and beneath the ground, generally to the east and south, in the Colstrip area. The tributaries to Richard coulee, Lee Coulee, and Hay coulee are to the southeast of the proposed mine area.

B Has the Dept. of State Lands conducted an in depth base line study of any of these tributaries named above, prior to the consideration of the mine application? If so, why weren't the results of studies of each included in this document?

C Nowhere in the area did the work of Renick (1923) find water of such contamination as that on Cow creek, and the e. f. of Armells creek. Why has it now deteriorated to such extent?

D You will say that the Renick study can not be considered becasue it was a one time testing trip, completed prior to such modern methods known today.

I will respond that the Renick study is a great deal more than that done by any other agency, including the Dept. of State Lands, prior to the onset of more coal stripmining. The U. S. Government did recognize the concern about groundwater, in 1923, something it seems to have forgotten now.

E Enclosed is a sheet from a U.S.G.S. computer analysis, the years 1979 through Jan. 1983, pertaining to Cow Creek. Please notice the column under Boron. Boron is not considered in the subject EIS. Why?

The bulletin, Quality Criteria for Water, published by the E.P.A., states the crteria for Boron is 750 ug/l for long term irrigation on sensitive crops.

F In the EIS, the degradation of Cow creek is taken for granted, not only now, but for thousands of years. Has the

A Thank you for your comments.

B These drainages are discussed in chapter III, Cumulative Hydrologic Effects, although no baseline studies have been completed. A more complete offsite assessment of cumulative water quality impacts has been included in the final EIS and in the Final Comprehensive Environmental Impact Study of the Rosebud Mine (DSL and OSM, 1983).

C In response to your letter of February 22, 1983, to the Department of State Lands, we pointed out the following:

> No one involved has ever denied that the field work was conducted before the inception of mining. The important point is that no samples were taken of either surface or alluvial water in Cow Creek. The only reference to water quality in Cow Creek is on page 110 (Renick and Riffenburg, 1929), last paragraph:
>
> "Shallow dug wells along Rosebud Creek and its tributaries, most of which are in the alluvium, yield hard water that in many places, though drinkable, is not particularly palatable."
>
> There are numerous other references to the generally poor quality of shallow ground water, both alluvial and bedrock, contained in the descriptions by townships.
>
> ...A point to keep in mind is that Renick's study consisted of a single set of samples taken over a 3-month period from a large number of wells. Thus, it is difficult to compare Renick's data to multiple samples collected from a set of wells over a number of years. No trends through time can be determined from Renick's data. However, Department personnel have calculated average TDS levels for bedrock units in the vicinity of Colstrip and compared them to data published in the Comprehensive EIS for the Rosebud Mine.

The only water quality sample reported in Renick's study that came from the Cow Creek drainage was completed in bedrock. One cannot compare this sample with the values reported for the Cow Creek and East Fork Armells Creek hydrologic system, which is composed of alluvial ground water and surface water runoff. The alluvial and bedrock systems, although connected, are necessarily of different water quality. Renick and Ruttenburg's study tells us nothing specific about the quality of water in these two creeks.

D There were no laws that required the company, the State, or the Federal government to collect water quality samples at Colstrip in the early days of mining, which began in 1925. It wasn't until the late 1960s and early 1970s that State and Federal regulations were passed dealing with water quality or surface coal mining. It is unfortunate that more studies like the one done by Renick and Ruttenburg were not done in the area, but such premining baseline studies were not being done, as a general rule, anywhere in the U.S. at that time.

State Dept. of Lands ascertained why it suddenly developed a malady, one that is of short history, because the trees and vegetation are dying now?. They were not dead, but luxurient ten years ago?. If they had been, they wouldn't still be standing.

G Is it possible that what has happened to Cow Creek and the e. f. of Armells creek will also happen to Lee Coulee, Richard Coulee, and Hay Coulee, the result of mining Area B Extension?

H Under what authority in state or federal law does the Dept. of State Lands and Office of Surface Mining site the right to degrade or destroy the property of off mining site landowners in pursuit of the Coal Tax Trust Fund and other benefits?

Please answer the above question in it's entirety.

I Area B Extension is a part of the comprehensive EIS compiled by Dept. of State Lands. The Hydrology section of that EIS is still in Draft form, and extremely poor. If the field work had been done with the care shown in the Renick (1923) report, it would have been admirable. It was not! Therefore, it would appear that the State must do considerable more work before it grants any more coal stripmining permits, pertaining to Hydrology.

Again, thank you for the opportunity to comment on the Area B - 2nd Extension.

Most Sincerely,

Patty Kluver

Western Energy has put in over 400 ground water wells around the mine to characterize baseline conditions for new mine areas and to document ground water quality changes as they occur. We have used such information to help characterize predevelopment conditions and to project possible increases in TDS levels due to mining and industrial development around Colstrip. (See additional text in chapter III, Hydrology, Cumulative Hydrologic Effects, and DSL and OSM, 1983b, chapter III, Hydrology, Ground Water and Surface Water Quality.)

E We compared water quality samples measuring boron in mine spoil water with samples from undisturbed water-bearing strata within and around the mine. We find no detectable difference in trace elements between the two. Therefore, we feel safe in saying that mining would not increase the already high boron levels in Cow Creek. (See added text regarding boron, chapter III, Ground Water--Changes in Area B After Reclamation and in MDSL and OSM, 1983b, section 3.2.3.) Neither mining nor industrial development are responsible for the relatively high boron levels found in the Cow Creek drainage (MDSL and OSM, 1983b, section 3.2.3).

F We have no sure way of determining why trees along Cow Creek are dying without doing site-specific studies. Raised alluvial ground water levels (saturating tree roots) or changes in alluvial ground water quality are possible causes. Such changes could have occurred due to natural causes--the mid-1970s were wetter than normal--or as a result of man-induced changes. Spreader dikes installed on Cow Creek in the 1950s and 1960s could have raised alluvial ground water levels downstream. Also, old Northern Pacific mine spoils were not regraded and revegetated for several decades and may have captured water, putting additional water into the alluvial ground water system, rather than allowing the precipitation to run off as surface water.

Both the spreader dikes and the old mine spoils could have added enough salts to the alluvial ground water to surpass a salt tolerance threshold, thereby killing the trees. The added precipitation of the 1970s may have also affected the alluvial ground water quality by flushing soil-accumulated salts into the ground water.

G See the text added to chapter III, Hydrology, Cumulative Hydrologic Effects of Mining Area B for a discussion of these coulees.

H The Department regulates mining operations according to the laws of the U.S. and the State of Montana. No law directs the Department to "pursue" coal tax revenues.

I Thank you for your comments.

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY — PROCE

06295385 - COW CREEK NEAR COLSTRIP MT — DISTRICT CODE

PROVISIONAL

WATER QUALITY DATA

DATE	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SILICA, DISSOLVED (MG/L AS SIO2) (00955)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	ARSENIC SUSPENDED TOTAL (UG/L AS AS) (01001)	ARSENIC TOTAL (UG/L AS AS) (01002)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BERYLLIUM, SUSPENDED RECOV. (UG/L AS BE) (01011)	BERYLLIUM, TOTAL RECOVERABLE (UG/L AS BE) (01012)	BORON, DISSOLVED (UG/L AS B) (01020)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CADMIUM SUSPENDED RECOVERABLE (UG/L AS CD) (01026)
OCT , 1979											
17...	.5	24	--	--	--	--	--	--	3700	--	--
NOV											
07...	.5	22	--	--	--	--	--	--	2100	--	--
FEB , 1980											
21...	.5	27	--	--	--	--	--	--	1900	--	--
MAR											
20...	.3	19	--	--	--	--	--	--	1100	--	--
APR											
17...	.5	19	--	--	--	--	--	--	1700	--	--
MAY											
22...	.5	23	2	1	3	0	0	0	1900	0	0
JUN											
19...	.6	24	--	--	--	--	--	--	1900	--	--
OCT											
30...	.6	18	--	--	--	--	--	--	1900	--	--
NOV											
19...	.5	21	--	--	--	--	--	--	2000	--	--
JAN , 1981											
21...	.7	19	--	--	--	--	--	--	1700	--	--
FEB											
25...	.4	16	--	--	--	--	--	--	1300	--	--
MAR											
25...	.5	15	2	1	2	0	0	0	1400	0	0
APR											
30...	.5	15	--	--	--	--	--	--	1800	--	--
MAY											
28...	.4	18	--	--	--	--	--	--	1400	--	--
DEC , 1982											
07...	.5	24			--		--	--	1700	<1	--
JAN , 1983											
25...	.5	22	--		--		--	--	1500	--	--

United States Department of the Interior
OFFICE OF SURFACE MINING
Reclamation and Enforcement
BROOKS TOWERS
1020 15TH STREET
DENVER, COLORADO 80202

APR 21 1983

April 19, 1983

Mr. Kit Walther
EIS Team Leader
Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Mr. Walther:

The Office of Surface Mining has reviewed the draft addendum EIS for the Rosebud Mine, area B, second extension, and has the following comments:

Specific:

A 1. page iii, line 3. Figure S-1 does not show the area of expansion, as is implied, just the very general area of area B. Figure I-3 would be a better reference.

B 2. page IN-1, line 2. This should read "parts of sections 7, 8, 17 and 18 of T. 1 N., R. 41 E. and parts of sections 12 and 13 of T. 1 N., R. 40 E.".

C 3. page IN-2, 2nd paragragh. You should reference the Rosebud Comprehensive study here and elsewhere in the EIS as applicable.

D 4. page IN-5, last paragraph. The readers of this EIS should be told which stipulations the Department is going to impose so that they can make informed comments on the EIS and the proposed action.

E 5. Figure I-6. It is practically impossible to see the premining topography under the postmining contours in most of this map. Where it is possible to see them, the pre- and postmining contours seem completely different.

F 6. page II-1, 2nd paragraph. Forty four pages of discussion, tables, and figures is not a "brief" chapter, particularly when the chapter on impacts is only 31 pages.

A Figure S-1 has been revised to better show the location of the extension.

B The text has been revised.

C The Comprehensive Environmental Impact Study is now referenced.

D It is not known which stipulations would be imposed until after publication of the final EIS, when the Commissioner of State Lands makes a decision on the permit application. As a result, only suggested mitigations are listed in the EIS. The reviewers of the draft EIS are free to comment on the merits of the suggested mitigations for the Commissioner's consideration.

E The printer has been directed to improve the clarity of this map for the final EIS. A much larger version of this figure is on file with the Department of State Lands and your office in Denver.

F The sentence has been revised.

G 7. Table II-2. By "flow through the area" do you mean total flow in that aquifer, flow per foot of thickness, or flow per unit width? A total flow of only 1 to 3 gpm seems very low for the entire 8,000 foot width of Rosebud coal, and would not be enough to support a well. (This question also applies to the discussions in the text.)

H 8. page II-15, 5th complete paragraph. None of the maps in this EIS show FAS 39 in relation to area B.

I 9. There is no mention of threatened and endangered species in the discussions of vegetation and wildlife.

J 10. page II-29, 3rd paragraph. Shouldn't the reference be to figure I-5?

K 11. page II-41, 6th paragraph. On page I-1 and elsewhere in the text, the area of the extension is given as 1,820 acres, not 1,834.

L 12. page II-42, 2nd paragraph. Interstate 94 is not shown on figure II-8.

M 13. page III-5, 3rd complete paragraph. Can you give an estimate of the increase in area influenced?

N 14. page III-6, table III-1. How much inflow will there be from the overburden and the coal? What will be done with the water after it is pumped out of the pit?

O 15. Figure III-3. This figure should show the difference between figures III-1 and III-2, but if you overlay the 2 figures and take the difference between their contours, you do not get figure III-3. For example, the difference in TSP north of area C is 40 ug/m^3, but figure III-3 shows 10.

P 16. page III-14, last paragraph. Why will the postmining forage production exceed premining? This needs to be discussed.

General

Q There is little or no discussion of cumulative impacts from all the mining and other development in the area.

Thank you for the opportunity to review the EIS. If you have any questions about our comments, please call Bill Weist (303) 837-5656.

Sincerely,

Allen D. Klein

Allen D. Klein
Administrator
Western Technical Center

G The 1 to 3 gpm is the estimated total amount of ground water believed to be passing through Area B in the Rosebud coal seam. The overburden of Area B carries from 5 to 30 gpm, mostly through the northeast corner of section 8. (See fig. II-4.) The Rosebud coal seam would not be a good target for ground water wells in the Area B extension area, but the Rosebud overburden and the sub-Mckay water-bearing strata probably would be. (See chapter II, Hydrology, Water-bearing Strata of Area B extension.)

H The reference has been changed to refer the reader to fig. II-5. FAS 39 is the highway passing through Colstrip. Figure II-5, opposite page II-15 in the draft, shows FAS 39. The road has also been labeled for the final EIS. FAS 39 has been added to fig. I-1.

I In regard to wildlife, please see our answer to letter 1. In regard to plant species, please see chapter II, Vegetation, first paragraph.

J Yes. Thank you for correcting us.

K Thank you for correcting us. The correct figure is 1,820.

L The figure has been revised.

M See revised text, Hydrology, Ground Water--Changes in the Extension Area During Mining.

N Table III-1 has been revised to show this data.

O The figures are correct. Note the following two points. First, the isopleth intervals are not equal in all three figures: figures III-1 and III-2 have 5-ug/m^3 contour intervals and figure III-3 has a 2-ug/m^3 contour interval. Thus, overlaying figures III-1 and III-2 would not give you figure III-3. Second, the figures do not show all the data generated by the computer model used to analyze air quality. Thus, for example, we know that in the area north of Area C to which you refer the TSP concentration in 1980 was near 30 ug/m^3 (figure III-1). That is, the TSP concentrations to the east of the 30 ug/m^3 isopleth are not 0, as you assumed in your statement. All that can be inferred from figure III-1 is that the TSP concentration is less than 30 ug/m^3. The TSP concentration of 40 ug/m^3 in 1988 minus the TSP concentration of 30 ug/m^3 in 1980 results in 10 ug/m^3, as shown in figure III-3.

P Due to past land use and grazing practices, many species present in premining vegetation communities do not reflect a climax condition. Reclaimed areas would probably contain more climax species, characteristic of more productive rangeland. Unproductive sites, such as gumbo knobs, corrals, and buildings would no longer exist. Drainages, now consisting of mostly shrubs and disturbed grassland, would be replanted with a productive lowland drainage mixture.

Q The cumulative effects of mining the entire Rosebud Mine are discussed in detail in the Rosebud Mine Comprehensive Environmental Impact Study (Montana Department of State Lands and Office of Surface Mining, 1983b). Cumulative impacts are also discussed, but briefly, in this addendum EIS for topics whose influence clearly extends outside the permit area--hydrology and wildlife, for example. You may have had the impression that cumulative impacts were not discussed because the cumulative discussion is not set apart as a separate section under each topic.

MONTANA HISTORICAL SOCIETY
HISTORIC PRESERVATION OFFICE
225 NORTH ROBERTS STREET • (406) 449-4584 • HELENA, MONTANA 59601

April 19, 1983

Mr. Kit Walther
EIS Team Leader
Department of State Lands APR 25 1983
1625 11th Ave.
Helena, MT 59620

RE: Addendum EIS, Western Energy Company's Rosebud Mine, Area B, Second Extension

Dear Mr. Walther:

A I reviewed the above document with respect to information presented on cultural resources. A computer file search for recorded properties on lands included in Area B, Second Extension, disclosed that there are two other sites, 24RB1031 and 24RB327, located in the direct impact area in addition to the sites mentioned in the DEIS. Table 2.13-3 in the recently distributed Draft Comprehensive EIS for the Rosebud Mine also cites the presence of these two sites in the direct impact area of Area B. To my knowledge, sites 24RB1031 and 327 have never been evaluated in terms of their National Register eligibility potential. It is not known whether either would qualify for listing or require any special consideration of measures to mitigate adverse effects resulting from mining operations.

B The discussion appearing on p.II-44 on site #24RB95, the West Homestead, correctly describes this office's re-assessment of its significance due to a greater emphasis placed on the historic, architectural, and information value of this type of site. A formal determination of eligibility was never requested since it was presumed to lie outside the area of environmental impact. However, the Draft Comprehensive EIS indicates that the site is actually situated in the direct impact area. Though activities and disturbances in the second extension of Area B may not affect the site, it would be appropriate to address whether other types

C of impacts are foreseen. Realizing, of course, that the permitting process involves discrete blocks of land and different time frames in the overall planning process, we see this segmenting of reviews as a short-coming for assessing cumulative impacts and arriving at reasonable mitigation proposals for sites that may undergo serious indirect effects before the direct effects of a particular mine plan even come to our attention.

A Thank you for the information regarding sites 24RB327 (Roadside Rings) and 24RB1031. Although Roadside Rings is located in Section 7, it is not in the direct impact area and, in fact, is not in the proposed permit area. It is, however, located in the buffer zone between Areas A and B. Site 24RB1031 was recorded and rested in 1971. This site was termed a "shelter"; however, there were no indications of human habitation and testing of the shelter floor further indicated no artifacts of any sort. The Department believes this site was evaluated for National Register significance in October 1981.

B As explained in responses to comments on the Draft Comprehensive EIS, and in other discussions with the preservation office, site 24RB95 (the West Homestead) is not located in a direct impact area but is between two direct impact areas. It has not been and would not be affected by mining. The greatest impact to this site is and would continue to be time and county road dust.

C Although the Department appreciates your concern over segmented reviews, the entire Western Energy area has finally been surveyed sufficiently that this should no longer pose a problem. There are no unsurveyed buffer zones in the interior and the life-of-mine area has been intensively surveyed for Areas A, B, C, D, and E. As such, although life-of-mine sign-off may not be issued by the State Historic Preservation Office, there should be no problem correlating the various surveys in the area on either a segmented or comprehensive basis.

LETTER 8

D As a final suggestion that might make the EIS a more self-contained document reflecting more thoroughly the cultural resource survey work that has been conducted to date, I recommend that the areal extent of both intensive and buffer zone surveys be superimposed on a map of the expanded mining Area B with reference to the reports of the survey results. This would alleviate confusion in the future about the type of coverage certain tracts received, the dates of surveys, contractors involved, etc.

Thank you for the careful consideration of our comments.

Sincerely,

Marcella Sherfy
Deputy SHPO

D Thank you for your comment.

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CHAPTER VII

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The following agencies and companies (other than those cited in the text) provided information used to analyze Western Energy's proposed permit amendment:

Montana Department of Commerce, Helena, Montana

Montana Department of Health and Environmental Sciences, Air Quality Bureau, Helena, Montana

Montana Department of Highways, Helena, Montana

Montana Department of Institutions, Helena, Montana

Montana Department of Revenue, Helena, Montana

Montana Department of State Lands, Coal Bureau, Helena, Montana

Montana Power Company, Colstrip, Montana

Northern Cheyenne Planning Office, Lame Deer, Montana

State Historic Preservation Office, Helena, Montana

Sunlight Development Company, Colstrip, Montana

U.S. Department of the Interior, Office of Surface Mining, Denver, Colorado

The Department of State Lands appreciates the assistance of Western Energy Company which provided the EIS team with information on the proposed mine.

Review of this Statement

In accordance with the Department's regulations governing environmental impact statements (EISs), copies of the draft EIS were sent to the public for comments and suggestions. All comments received were carefully considered in the preparation of the final EIS. Comments on the final EIS can be sent to Commissioner Dennis Hemmer, Department of State Lands, Capitol Station, Helena, MT 59620.

The final EIS is available for review in the following places:

. Montana Department of State Lands, 1625 11th Avenue, Helena, Montana.

- Big Horn County Public Library, 419 North Custer Avenue, Hardin, Mont.
- Miles City Public Library, 1 South 10th, Miles City, Montana.
- The Rosebud County Library, 201 North 9th Avenue, Forsyth, Montana.
- Parmley Billings Public Library, 510 North Broadway, Billings, Mont.
- Sheridan County Fulmer Public Library, 320 N. Brooks, Sheridan, Wyom.

A limited number of copies are available on request from the Department of State Lands, Capitol Station, Helena, MT 59620.

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